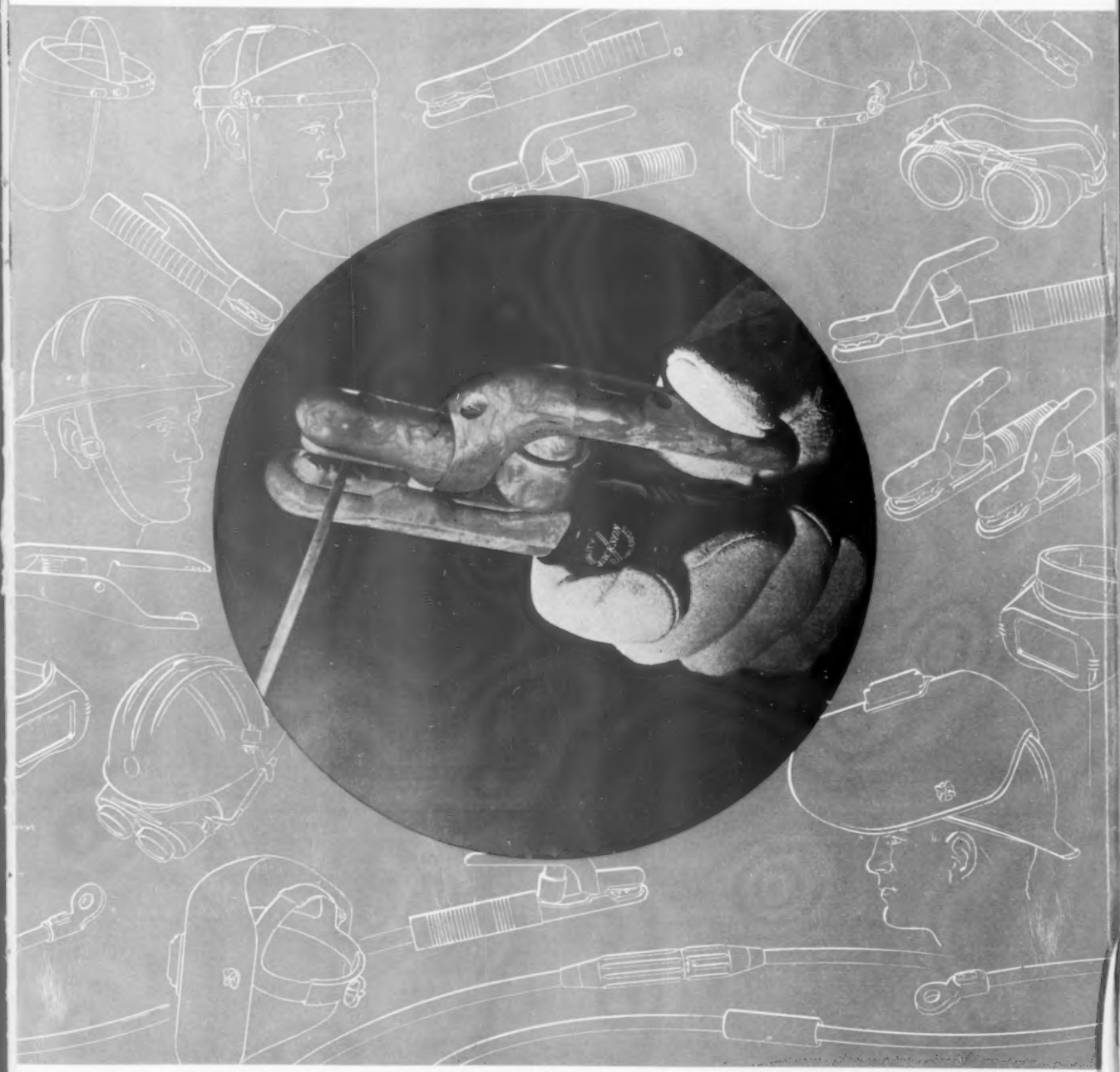
Welding Engineer

PRICE 50 CENTS

AUGUST, 1957



Jackson Electrode Holders, Ground Clamps, Cable Connectors, Splicers and Lugs
Jackson Safety Hats, Welding Helmets, Goggles and Eyeshields
Sold World-Wide through Distributors and Dealers

Jackson Products
AIR REDUCTION SALES CO., A DIVISION OF AIR REDUCTION CO., INC.
WARREN • MICHIGAN

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SuperLite™

ALUMINUM SAFETY HAT

No. A-1 (Leatherette Sweatband)
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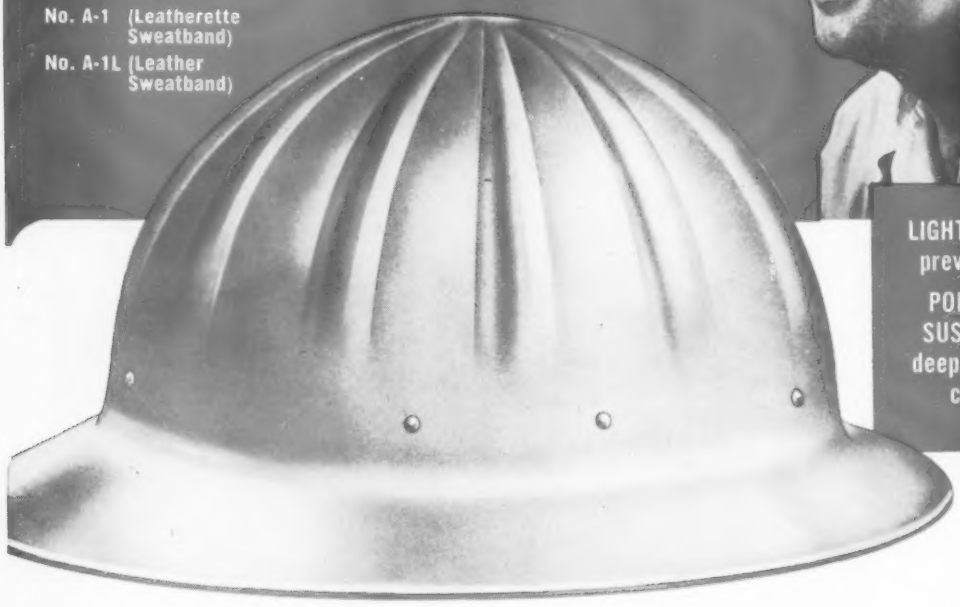

LIGHT, STRONG . . . prevents fatigue!

POLYETHYLENE SUSPENSION . . . deep, comfortable, cool, clean.

SuperLite Features:

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2) **COOL** . . . reflects, does not absorb heat. Well ventilated.

3) **COMFORTABLE** . . . men prefer and LIKE to wear *SuperLite!*

4) **ONE SIZE FITS ALL HEAD SIZES.**

5) **NO LACING** . . . exclusive design! Only headband ever needs replacing . . . a big saving!

6) **TOPS IN HYGIENE** . . . easily sterilized. Waterproof.

7) **NON-TOXIC** . . . mildew- and fungus-proof Polyethylene suspension. No deterioration.

8) **FULLY TESTED** . . . to exceed highest safety standards.

9) **LIGHTWEIGHT** . . . trim and good looking.

This NEW *SuperLite* Safety Hat was designed by Fibre-Metal to give you dependable, cool, light and comfortable head protection.

SuperLite Hat "shells" are of tough aluminum alloy, tempered and ribbed for maximum resistance to blows from flying or falling objects. *SuperLite's* exclusive Polyethylene suspension gives maximum shock absorption and unmatched comfort. It is *and remains* flexible, conforms to head shape, and is deep fitting to "stay put" in any working position.

Order SuperLite Aluminum Safety Hats NOW from your Safety and Welding Distributor!

REAL WEARING COMFORT — Polyethylene Suspension is resilient, form fitting . . . shapes to wearer's head . . . ideally comfortable. Easily adjusts for depth . . . for "air conditioned" separation from shell. Easily removed and replaced. No metal parts.

Ask your Safety & Welding Supply Distributor for Bulletin #55, or WRITE . . .

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INSULATED EUREKA HOLDERS
HEAD REST GOGGLES • WELD CLEANING HAMMERS • FRESHAIR SYSTEMS
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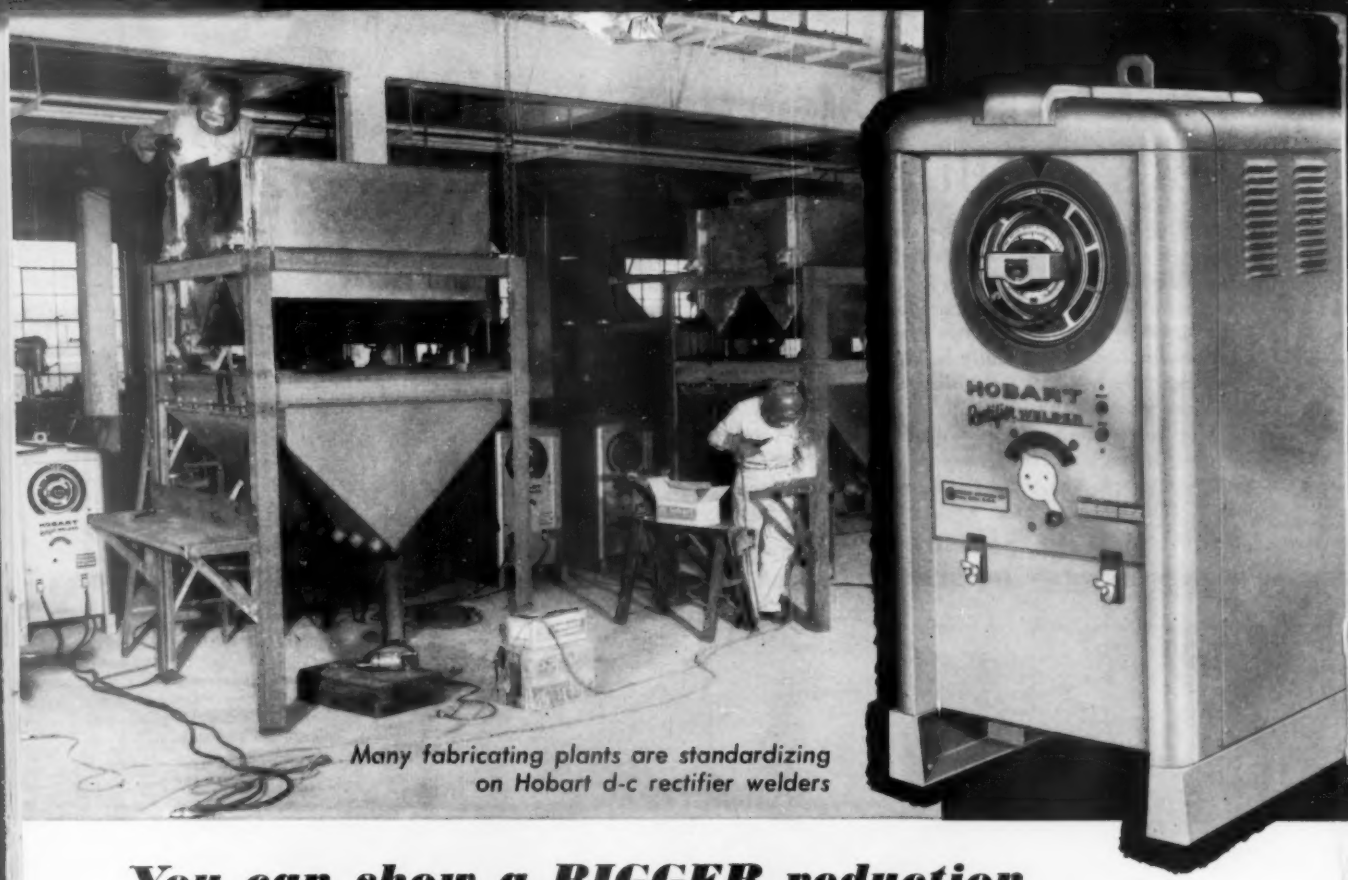


Many fabricating plants are standardizing on Hobart d-c rectifier welders

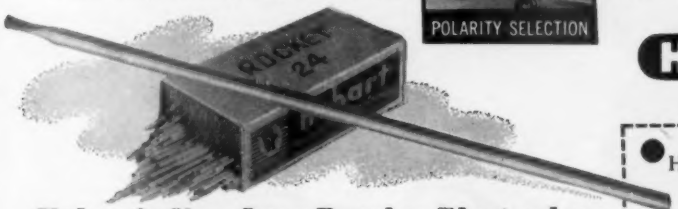
You can show a BIGGER reduction in welding costs by using HOBART D-C RECTIFIERS!

HOBART'S constant development work in building better welding equipment gives you extra feature advantages that let you show a bigger savings on your welding work. You can greatly expand your production capacity with these new, faster and easier to use "diverter path" design arc welders. These new models have many time saving features that let your welding operators speed their work with assurance of high quality welds. You'll be amazed at the wide welding range and superior performance of the Hobart DC Rectifiers. Brings easier arc striking, better arc stabilization and smoother weld metal deposit with less spatter loss. Remote control, an added feature, comes at no extra cost and guarantees just the right heat at the work without the need for repeated trips to the machine for making adjustments. Here's a welder that justifies checking and comparison, if you want high overall efficiency and more economical operating and maintenance in your welding department. Be sure you get the latest information for your file on this new outstanding welder value. Mail coupon today—no obligation. HOBART BROTHERS CO., Box **U-87**, Troy, Ohio *'phone FE 2-1223*

"One of the world's largest builders of arc welding equipment"

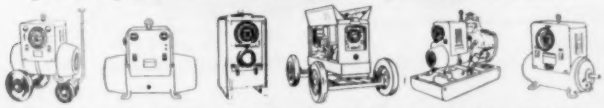
POLARITY SELECTION

REMOTE CONTROL



Hobart's New Iron Powder Electrodes

This new contact type electrode is heavily coated with iron powder which becomes part of the weld. Try the new Hobart "Rocket 24" electrodes (E-6024). See how they give you greater speed, maneuverability, strength and smoothness.


1. Electric Drive 2. Automatic 3. AC-DC 4. Gas Drive 5. Air-Cooled 6. Belted

HOBART TROY OHIO **WELDERS**

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HELIARC Welding
finds satellite jobs are right in its orbit

Welding together sections for an earth satellite, under the most exacting specifications, may not be your particular problem. But if welding light-gage, hard-to-weld metals is slowing up your production—LINDE's HELIARC Inert Gas Shielded Arc Welding, using LINDE Argon as a shielding gas, may be just what you've been looking for.

HELIARC Welding is LINDE's method for high-speed fusion of commercial metals, automatically, or manually in all positions. LINDE Argon, guaranteed 99.99% pure, protects the weld. It is readily available, in cylinders or in bulk, from convenient sources all over the nation.

Get more information about HELIARC Welding and LINDE's other modern welding methods. For a free copy of the booklet, "Modern Methods of Joining Metals," address Dept. WE-8, LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. *In Canada:* Linde Company, Division of Union Carbide Canada Limited.

FOR THE BEST IN ELECTRIC WELDING—LOOK TO LINDE!

Shells of the Earth Satellite, Project Vanguard, are made of .050-in. magnesium alloy sheet, containing small amounts of aluminum and zinc. The two hemispheres are manually welded together (above), with a cover ring, by HELIARC Welding, a LINDE development utilizing an argon-shielded tungsten arc. Brooks & Perkins, Inc., are the fabricators.

Linde TRADE-MARK

UNION CARBIDE

The terms "Linde," "Heliarc" and "Union Carbide" are registered trade-marks of Union Carbide Corporation.

Welding Engineer

AUGUST, 1957
VOL. 42—No. 8

THE MAGAZINE OF JOINING
AND SEVERING OF MATERIALS

America's Pioneer publication which, combined with The Acetylene Journal, has been devoted to the interest of the welding and allied industries since 1898

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FOR MANUAL APPLICATION

THIS HARD-FACING ROD	FOR THESE CONDITIONS	FOR THIS EQUIPMENT	APPLI-CATION
VICTORTUBE	Severe abrasion	Ripper and ditcher teeth, dredge cutter blades, posthole augers, oil field tools, pug mill knives	ACETY. AC-DC ELEC.
VICTORTUBE BARE-30-DOWN	Severe abrasion	Agricultural tools	ACETY. ONLY
VICTORTUBE "SPECIAL"	Abrasion, severe impact	Oil field bits, rock bits	ACETY. ONLY
VICTOR TUNGSMOOTH	Thin cutting	Augers, bits, blades, screw conveyors, farm tools	ACETY. AC-DC ELEC.
VICTORITE	Earth abrasion, sliding friction	Farm tools, earthmoving rigs	ACETY. AC-DC ELEC.
TUBE VICTORITE	Abrasion, impact	Plow points and farm tools	ACETY. AC-DC ELEC.
VICTORITE 1	Corrosion, heat, abrasion	Chemical and food machinery, arbors, screw conveyors, soaking pit tongs	ACETY. AC-DC ELEC.
VICTORITE 6	Red heat, impact corrosion, abrasion	Forming dies, exhaust valves, cams, steam valves	ACETY. AC-DC ELEC.
VICTORITE 12	Heat, abrasion, impact	Saw blade inserts and other critical applications	ACETY. AC-DC ELEC.
VICTORITE CARBON ARC	High abrasion, thin deposit	Plowshares, lister shares, sweeps	CARB. ARC ACETY.
VICTORALLOY	Abrasion, severe impact	Crushers, dredge pumps and cutters, dipper teeth, tampers, rollers, idlers	ACETY. AC-DC ELEC.
VICTORALLOY #1	High abrasion, medium impact	Bucket lips, rock crushers, muller tires, gyratories	ACETY. AC-DC ELEC.
VICTORALLOY "A"	Angular shock, extreme impact, build-up	Clutch parts, gears, crusher plates, gyratory mantles, build-up for hardfacing	AC-DC ELEC. ONLY
VICTORALLOY "B"	Heavy impact, moderate abrasion	Tractor rollers and sprockets, shovel pads, plates, idlers, etc.	AC-DC ELEC. ONLY
VICTORALLOY "C"	High abrasion, moderate shock and impact	Tractor grousers, pressure rolls, crusher segments, roll crusher teeth	AC-DC ELEC. ONLY
VICTOR MULTI-PASS	Impact, compression, build-up	Drive sprockets and tumblers, rollers, idlers, churn drills, clutch jaws	AC-DC ELEC.

What's proper Victor rod for your hardfacing needs?

THIS CHART GIVES YOU QUICK ANSWER

Use it to select right rods for prolonging operating life of your equipment. You'll be selecting rods that go on quickly and smoothly, thereby saving labor and downtime. Order from your Victor dealer TODAY.

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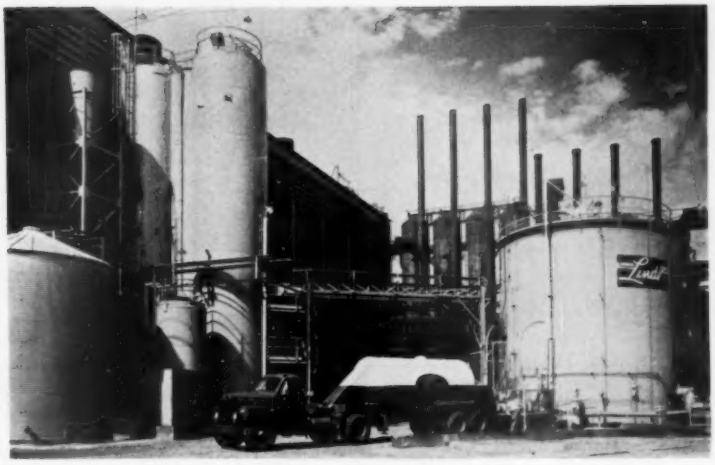
FOR AUTOMATIC & SEMI-AUTOMATIC APPLICATION

THIS TYPE	FOR THESE CONDITIONS	ON THIS KIND OF EQUIPMENT
#0	High abrasion, medium impact	Crusher rolls, rock crushing equipment
VA #1	Abrasion, medium impact	Crushers, scraper blades
VA #2	Abrasion, impact, Multi-pass application	Steel mill applications, tractor idlers
VA #3	Abrasion, light impact	Mill guides, crushers, dredge bushings
VA #4	Multiple layer build-up	Tractor rollers and idlers, sheave wheels
VA #5	Heavy impact, abrasion	Tractor rollers, idlers, mine car wheels, sheave wheels
VA #6	Medium abrasion, high impact	Crane wheels, drums, roll necks
VA #7	Abrasion, high impact	Build-up for hardfacing, mine car wheels
VA #8	Abrasion, high impact	Roll crushers, scraper and grader blades, tool joints
VT #60	Extreme abrasion	Tool joints, grader blades, scraper blades
Mo-Mn	Manganese build-up	Wherever manganese build-up needed



RIGHT: Over 500 tons of oxygen is produced each day at this Linde plant. Storage tank has 10 million cu ft capacity. Compression, purification, and other equipment is housed in the building at left. ABOVE: Little—40 in. tall, 60-lb—Eugene David, an Augusta, Ga., weldor, slips easily into a 15-in. opening to repair a weld in a reactor vessel. Michael Velgos helps David. The feat was first reported in the *Between Passes* section of the June *Welding Engineer*.

News

Wee weldor works wonders

It took a little man to do a big job.

A routine X-ray check turned up a trouble spot inside an 18-in. stainless steel outlet pipe leading from the reactor vessel of Westinghouse's nuclear plant, part of the AEC-Duquesne Light Co.'s atomic-electric power plant at Shippingport, Pa.

Since the pipe, part of the reactor coolant system, will contain radioactive water, all welds must be perfect.

The trouble spot was at a joint between two sections of the heavy pipe. It would be too costly to break open the weld, so Dravo Corp., installers of the nuclear plant, huddled to find a solution.

He is 3 ft 4 in. Eugene David, a weldor for DuPont.

David simply crawled 10 ft. through the 15-in. pipe, passing through a 13 in. hydraulic valve en route to the faulty weld. Once inside, he found that damage had occurred during the first "blind" welding pass made to join the two sections of pipe. The wiry weldor merely ground out the rough area and filled it with new weld metal.

Streamlined plant for grinding wheels

Organic bonded grinding wheels will be manufactured at a new $6.5 million plant being built by Norton Co., Worcester, Mass. To be finished in mid-1959, the plant has been designed for straight line production of wheels up to 30 in. in diameter.

The new Plant 8 will be 320 ft wide and 620 ft long. Sides and windows will be of aluminum construction, with the building front brick-faced. The steel-decked, flat roof will be covered with tar and gravel.

Offices will be air-conditioned, and to insure high quality in certain steps of the wheel making process, part of the manufacturing area will be air-conditioned.

Color conditioning, recommended by experts, will make for safe and pleasant working conditions.

The plant, designed by Norton's engineering department, is parallel to Plant 7.

Hilton Hotel cool, thanks to welding

Chicago's Conrad Hilton will soon have more air-conditioned rooms than any hotel in the world—and welding plays a big part.

Piping in the 95 riser systems is welded; it is fabricated of carbon steel. Changes in direction are accomplished with Tube-Turn fittings.

A $3 million contract with the Borg-Warner Corp. calls for two 800 hp turbo water cooling systems capable of chilling five million gallons of water daily. Over 3,300 induction air units will be installed in guest rooms.

Linde, U.S. Steel work together

Linde Co.'s new gaseous oxygen producing unit successfully ended its test period and is in regular production for U. S. Steel Corp.'s plant at Duquesne, Pa.

A good example of industrial cooperation, the Linde-run plant is wholly in the service of the Duquesne works.

The unit produces over 500 tons of oxygen per day. Low purity oxygen is piped to two ferromanganese blast furnaces at the rate of 430,000 cu ft per hour. An initial delivery rate of 42,000 cu ft per hour of high purity oxygen goes to the pipelines servicing electric furnaces, scarfing machines and other steel mill operations.

In case of shutdown, a 15-hour reserve tank will store 10 million cu ft of gas.

Refinery of future uses nickel alloy

Over one million lb of nickel alloy was used in constructing Tidewater Oil Co.'s recently dedicated "refinery of the future," according to International Nickel Co., Inc. With its 130,000-barrel-per-day capacity, the new refinery has the largest initial capacity of any oil refinery ever built. It is near Delaware City, 15 miles south of Wilmington, Del.

INDIVIDUAL welding booths are completely equipped with their own d-c welder. An a-c welder is shared with the adjoining booth. Equipment includes a classroom and locker room for students. Trainees can test their welds to destruction in a 75-ton hydraulic press. (See story below.)

BECAUSE small surface cracks in welds on heavy ship plates are difficult to detect with X-rays, the Brooklyn Navy Yard uses magnetic particle inspection techniques to supplement radiography procedures. Here Navy technicians use a Norelco Portaflux unit to check a weld for longitudinal defects.

Efficiency plus in weld school

Because "welding quality is vital in the manufacture of all large electrical apparatus," General Electric Co. operates an around-the-clock welding school at its Large Motor and Generator Dept. in Schenectady.

More than $75,000 worth of equipment and facilities are used to give individualized, practical instruction in all kinds of welding. G. E. feels that the cost of the school will be repaid in higher quality work with fewer rejects.

Primarily for department employees, the school can handle up to 51 students at a time. Training period is from eight to 12 weeks, with each student progressing at his own rate. Each man receives his regular wage while attending school.

A 400-amp motor-generator-type d-c arc welder is in each of the 14 hand welding booths. Every two booths share a 500-amp transformer-type a-c welder. In an adjoining area is a 400-amp d-c machine for inert-gas-shielded welding of aluminum and special alloys, and gas cutting and arc scarfing equipment.

Special fixtures at each station allow the trainee to weld test plates in overhead and vertical positions. Sample welds are tested to destruction in a 75-ton hydraulic press.

A classroom equipped to show slides and movies takes care of the theoretical side of welding.

Boston AWS hosts conference

With the Boston section of the American Welding Society as host, all sections of District One will sponsor the second annual New England Conference on Welding Sept. 18, in Boston.

The first technical session will cover high temperature brazing, welding stainless steel and welding for nuclear reactors. In the second session, automatic, tool steel and magnetic force welding will be discussed. A social hour and banquet will follow.

Linnehan in permanent quarters

Newly-formed Linnehan Welding Supply Co., has moved from temporary quarters to 3235 W. Cameron Ave., Milwaukee 9, Wis.

Denver is site of X-ray meet

The sixth annual conference, Industrial Applications of X-ray Analysis, will be held in Denver August 7-9. It is sponsored by the Metallurgy Division, Denver Research Institute of the University of Denver.

Crucible opens Chicago warehouse

Over 600 industrialists and businessmen saw the opening of Crucible Steel Co.'s expanded specialty steel warehouse at 4510 W. Cortland St., Chicago 38, Ill.

By doubling the size of the Chicago warehouse and sales office, Crucible maintains its position as the nation's largest system of special purpose steel warehouses, according to Joel Hunter, company president.

Greeting visitors at the opening were D. K. Stuart, Chicago branch manager, and E. D. Streeter, former manager and now Midwestern regional manager.

Army transports atom power plants

The Army is constructing small nuclear power plants that can be moved by air to remote bases. The units operate for long periods on a single charge of enriched uranium. Called the Army Package Power Reactor, the first plant is now generating electricity at Fort Belvoir, Va. The facility was built by Alco Products, Inc. It has a gross output of 2,035 kw and could serve a community of 2,000.

The primary piping of the Fort Belvoir APPR is type 304 stainless steel. Outside diameter is 12¾ in. and it has a ¾ in. wall. Directional changes are made with Tube-Turn welding fittings.

Norelco holds service school

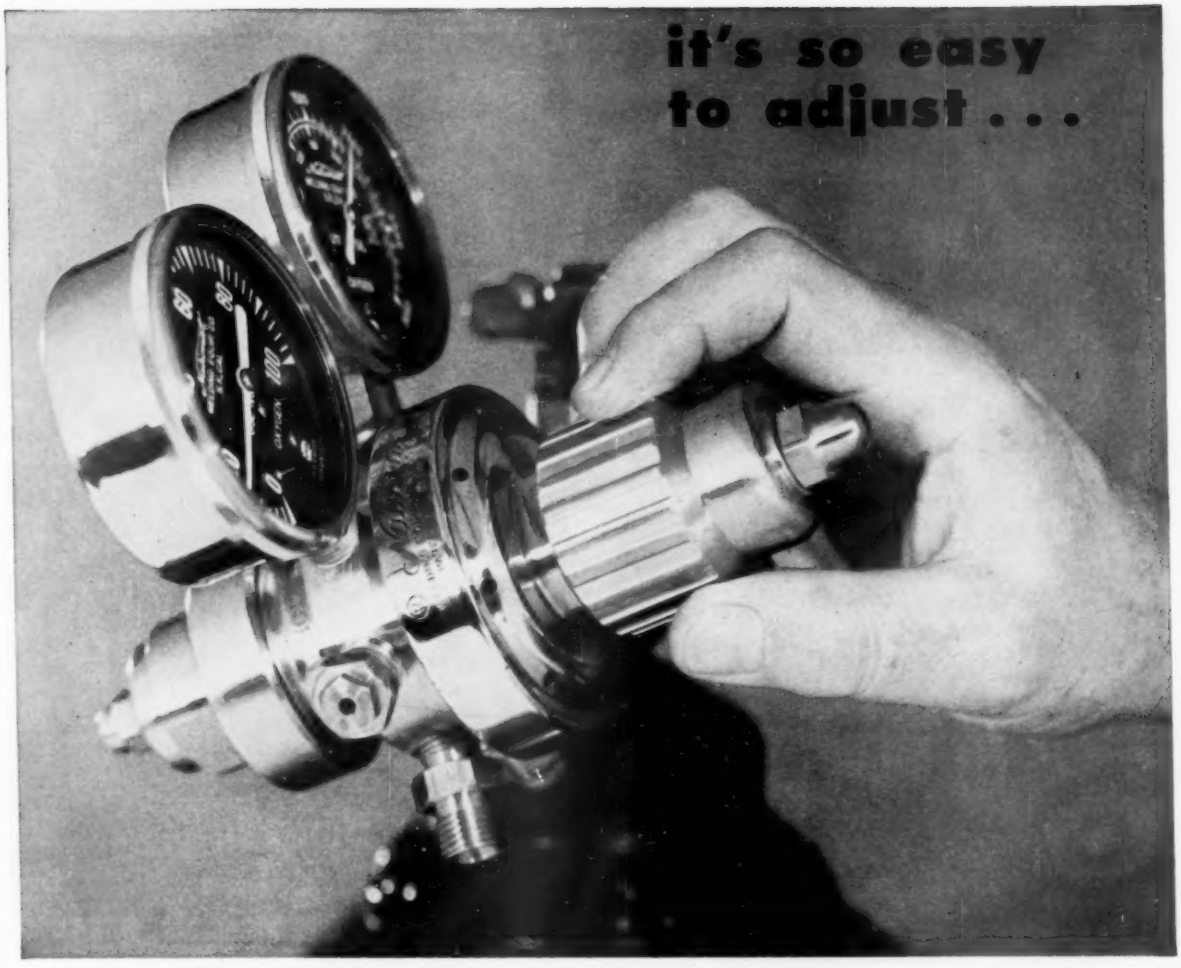
To coordinate service activities of Norelco regional offices and dealer organizations and acquaint personnel with proper procedures on new instruments, the company held a service school June 24 to 28.

The five-day training course was at the Philips Electronics, Inc., plant in Mount Vernon, New York. Instruction covered X-ray spectrographic and diffraction equipment, particularly installation procedures, alignment, operation, individual circuit functions and trouble shooting.

Evansville gets welded arena

More than 25,000 pounds of welding electrodes and 1,000 tons of structural steel have been combined in the framework of the municipal Sportscenter in Evansville, Ind. Eight

(Continued on page 77)



just touch the adjusting screw — you will love the freedom of action — the instant response

The first time you touch the adjusting screw of this regulator you will be utterly amazed at its easy action.

Such adjustability and working accuracy suggests the wonderful care taken in the designing and manufacturing of this precision instrument — and one glance at the beautiful appearance shows quality throughout.

National of . . . california

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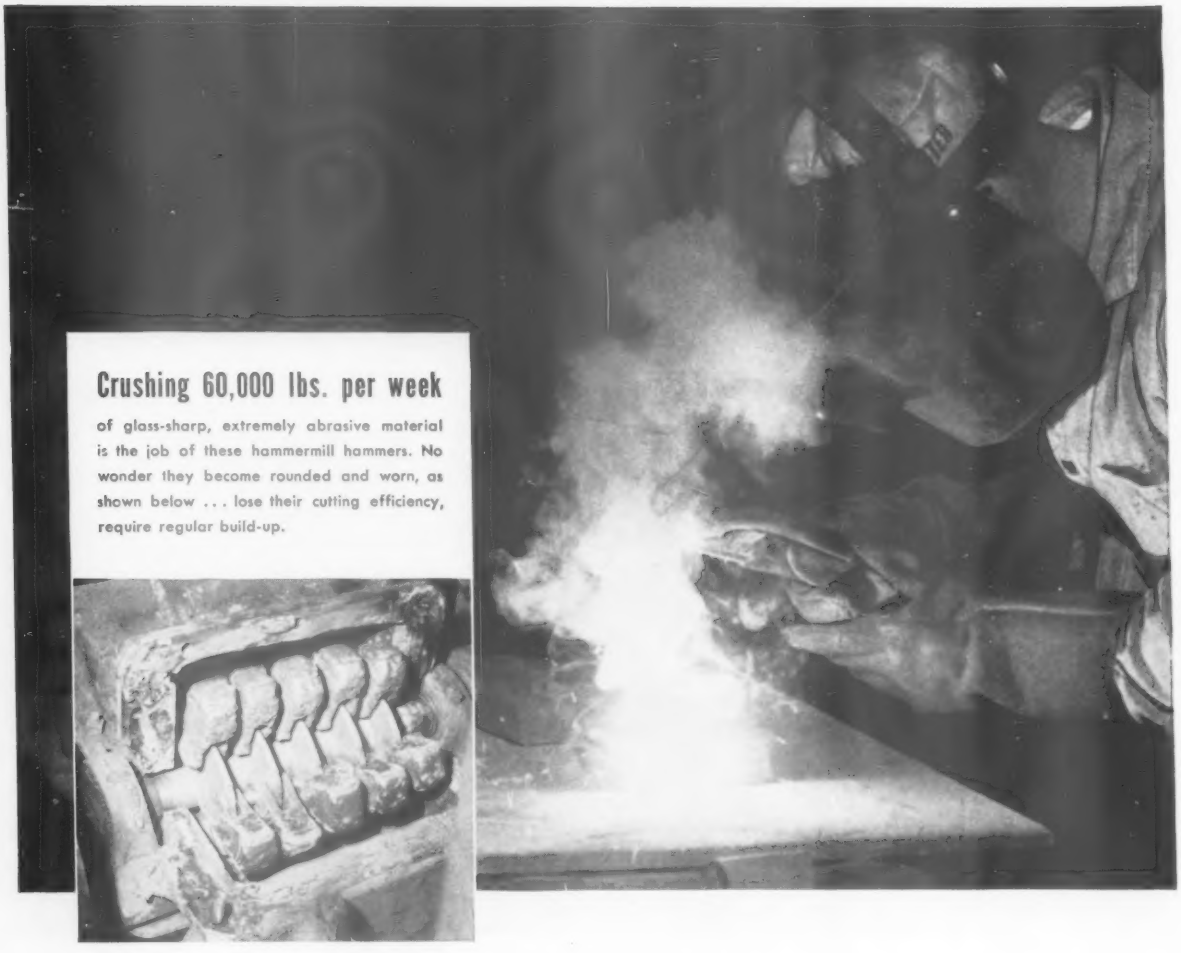


Crushing 60,000 lbs. per week

of glass-sharp, extremely abrasive material is the job of these hammermill hammers. No wonder they become rounded and worn, as shown below . . . lose their cutting efficiency, require regular build-up.

HARDFACING WITH AMSCO® SUPER HF-20

doubles service life . . . cuts electrode costs

Welding Flux Processing, Chicago Heights, Illinois, know a good thing when they see one. That's why they've switched *exclusively* to Amsco Super HF-20 Electrodes for hardfacing of these hammers. They're saving three ways:

1. Service life of the built-up hammers and the mill housing itself has been doubled, because of Super HF-20's high abrasion resistance.
2. Super HF-20 electrodes cost about 40% less than the type previously used.
3. Welding speed is stepped up. Super HF-20, an iron powder "contact" electrode, is easy to handle and gives a high deposition rate.

In this and many other severely abrasive applications, Amsco Super HF-20 has *proved* its ability to provide superior wear resistance at low cost. Available from stock in 3/16" diameter, to handle hardfacing jobs of almost any size.

Call your nearby Amsco Welding Distributor now for a demonstration of Super HF-20. Or write direct for technical data to: Amsco Welding Department, Chicago Heights, Ill.

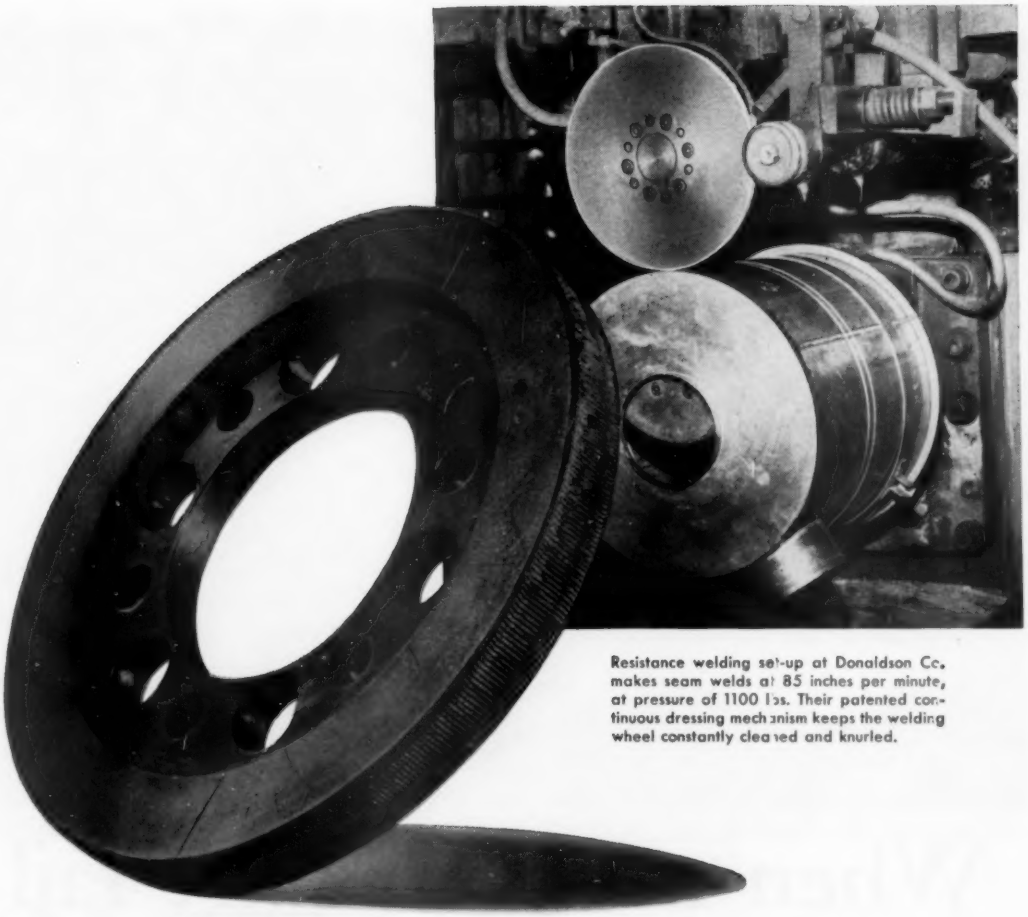
Amsco Welding Products distributed in Canada by Canadian Liquid Air Co., Ltd.

AMERICAN Brake Shoe COMPANY

AMSCO

American Manganese Steel Division • Chicago Heights, Ill.

OTHER PLANTS IN: DENVER, LOS ANGELES, NEW CASTLE, DEL., OAKLAND, CAL., ST. LOUIS; JOLIETTE, QUEBEC



Resistance welding set-up at Donaldson Co. makes seam welds at 85 inches per minute, at pressure of 1100 lbs. Their patented continuous dressing mechanism keeps the welding wheel constantly cleaned and knurled.

Half a Million Feet of Seam... Welded by This Mallory Wheel

How long do Mallory seam welding wheels last? Here's an example.

At the Donaldson Company, St. Paul, Minnesota, the Mallory 22 seam welding wheel shown above has just been retired after making about 500,000 feet of 1/8" lap mesh weld on the body sections of big internal combustion engine air cleaners. This service, according to Donaldson, is 3.2 times the life that they used to get with ordinary seam welding wheels.

Several reasons are behind the long life of Mallory wheels. Specialized alloys go into them, developed by Mallory during more than 30 years of leadership in resistance welding. Equally important is the extreme hardness and wearing ability that Mallory adds to these alloys. The result—more welds, better welds, per dollar.

For a cost-cutting consultation on your own resistance welding applications, see your local Mallory Welding Distributor. He carries a complete stock of Mallory electrodes, holders, seam welding wheels and bar stock. And he's well qualified to help you apply these precision-made products profitably.

Expect more... get more from

P. R. MALLORY & CO. Inc.

MALLORY

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For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio

OX-250 / *a proved G.E. X-Ray product to make your products better*

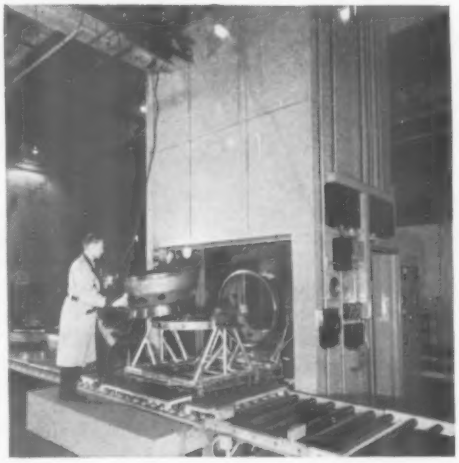
When missions can't fail...

G-E x-ray inspection detects trouble before it starts

This lean and lethal atomic bomber travels lighter, faster, safer thanks to engine weld inspection with the General Electric OX-250. No beefed-up design to compensate for weak welds on its J-57 turbo-jet components. No excess bulk to hamper speed. G-E x-ray spots troubles before they start.

In addition, the semi-automatic OX-250 at Ford's Aircraft Engine Division plant in Chicago does the work of four conventional units. Speeds inspection while it cuts down risks and costs.

Whatever your own production "mission" . . . from light alloy to armor plate . . . General Electric has x-ray apparatus to meet your needs. Call your local representative. Or write X-Ray Department, General Electric Company, Milwaukee 1, Wisconsin for Pub. AE-84.



FORD AIRCRAFT ENGINEERS GIVE J-57 COMPONENTS A LIFE-SAVING "LOOK" to assure defect-free welds. Stainless steel .093-inch welds on diffuser cases above are about 10 feet long . . . must be 100% sound. Operator prepares second case for radiographing while first case moves into cabinet.

Progress Is Our Most Important Product

GENERAL ELECTRIC

with VICKERS* Controlarc* the Versatile DC Welder

Ford Motor Company's Aircraft Engine Division was one of the first to use the Vickers Controlarc DC Welder.

At the time this versatile magnetic-amplifier-rectifier welder was first introduced, Ford had just completed a survey of all the welders on the market. From this study followed recognition of the need for a welder that would provide: better arc stability, retention of arc characteristics under line voltage fluctuations, wider current range and good performance at very low currents, quick speed of response and recovery from arc short, control of volt-ampere curve and easy remote foot control. It was evident that a *true* magnetic amplifier welder would most closely meet the special requirements of their aircraft fabrications.

Today, many companies in the aircraft industry acknowledge the excellent performance characteristics of the Controlarc, and have accepted this fine machine in the fabrication of aircraft, guided missiles and nuclear components.

From exacting aircraft requirements to simple, rugged heavy load air-cutting—the Vickers Controlarc can do a job for *you*.

WRITE TODAY for information.

*Trademarks

VICKERS ELECTRIC DIVISION

VICKERS INCORPORATED a unit of Sperry Rand Corporation

1851 LOCUST STREET • SAINT LOUIS 3, MISSOURI

ACCESSORIES FOR GAS WELDING

AIRCO RODS FOR WELDING STEEL

#1 is designed for welding low carbon and low alloy steels including grade A and B pipe.

#4 is a low priced, general purpose, high tensile steel rod.

#7 mild steel rod is used for every day welding of sheets, plates, etc.

AIRCO GOGGLES

Cover goggles protect eyeglasses and shut out glare. Fit over any type of eyeglasses.

Welding and cutting goggles give excellent ventilation without light filtration.

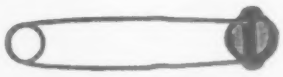
Airco replacement lenses available in all densities to fit your frames.

AIRCO GLOVES

Tough #1 Carpincho leather . . . suitable for gas or arc welding. Other glove types available include horsehide and asbestos models.

AIRCO WELD-CLEANING TOOLS

Atlas Model A Dual Tool consists of a combined chipping hammer with chisel head and detachable wire bristle brush.



AIRCO SPARKLIGHTER

For instant lighting of gases. A hood directs sparks. Round renewal flint tips are replaceable.

AIRCO-TWIN HOSE

Two neoprene lined, rayon cord reinforced hoses molded into a single unit . . . doesn't kink.

With or without connections. Meets I.A.A. specifications.

AIRCO CYLINDER TRUCK

Two-wheel hand truck assures good balance. Semi-pneumatic tires. Strong, rigid, welded steel frame. Other large-wheeled models for soft, uneven or rough surface conditions.

ATLAS CAST IRON WELDING FLUX

Floats out oxides and impurities to assure sound cast iron weld metal. Apply by dipping heated end of filler rod into the flux.

MARVEL BRAZE WELDING FLUX

The general purpose flux . . . remains molten and viscous over a wide temperature range. For conventional welding and braze welding of cast iron, malleable iron, steel, copper, brass and bronze.

HI-TEST BRAZE WELDING FLUX

For braze welding with brass rods on steel, malleable iron or other metals. Provided in paste form to permit uniform application to both work and rod.

AIRCOSIL SILVER BRAZING FLUX

Entirely fluid at 1100°F and remains fluid and active over a wide temperature range. Use with AIRCOSIL alloys when silver brazing stainless steel, nickel, monel copper, brass and other ferrous and non-ferrous alloys.

FREE AIRCO CATALOG

Newly revised. Presents the complete lines of Airco Welding Supplies and Accessories. Completely illustrated. Includes specifications, applications and ordering data.

Write for Catalog 9-13

welding
AT THE FRONTIERS OF PROGRESS YOU'LL FIND . . .

AIRCO®

Offices and dealers in most principal cities

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A division of Air Reduction Company, Incorporated
150 East 42nd Street, New York 17, N. Y.

On the west coast — Air Reduction Pacific Company
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In Cuba — Cuban Air Products Corporation
In Canada — Air Reduction Canada Limited

Products of the divisions of Air Reduction Company, Incorporated, include: **AIRCO** — industrial gases, welding and cutting equipment, and acetylenic chemicals • **PURECO** — carbon dioxide — gaseous, liquid, solid ("DRY-ICE") • **OHIO** — medical gases and hospital equipment • **NATIONAL CARBIDE** — pipeline acetylene and calcium carbide • **COLTON** — polyvinyl acetate, alcohols, and other synthetic resins.

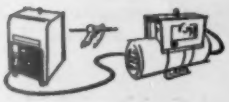
AUGUST
1957

Your

Weld World

at press time

Last minute news of interest to those engaged in joining and severing materials.



. . General Electric Co. announced early in July that it will discontinue manufacture of arc welding equipment . . . D. A. Hopper, general manager of the welding dept., promised fulfillment of "commitments to users" and completion of "contractual obligations to distributors." No plans for disposition of the department's York, Pa., plant and facilities were reported.

. . Ever-expanding Air Products, Inc., Allentown, Pa., continues to make news. In recent weeks, firm bought Aldan Oxygen Mfg. Co., Philadelphia, and renamed its Cylinder Gas Division the Industrial and Medical Gas Division.

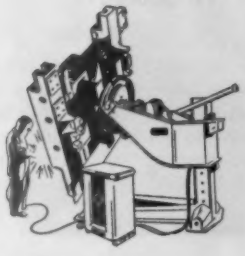
. . National Cylinder Gas Co., Chicago, has been granted exclusive U. S. manufacturing rights to a Swiss welder that joins standard rails into one continuous ¼-mile length in less than 2¼ hours. The Schlatter rail welder will be leased or sold to American railroads. Entire unit—welder, diesel power source and accessories—occupies three freight cars.

. . Sonobond Corp. is new subsidiary formed by Aeroprojects, Inc., West Chester, Pa., to manufacture, sell and service ultrasonic metal-joining equipment that the parent firm has developed. Line includes ultrasonic welding, brazing and soldering apparatus. W. C. Potthoff, a vice president of Aeroprojects, has been named president of new concern, also to be located in West Chester.

. . Increase in steel prices—$6 per ton—has caused much anguish but so far has not been reflected in price increases of autos, machinery, etc.

. . Chromalloy Corp., White Plains, N. Y., recently announced development of a new type of stainless steel sheeting that can withstand temperatures as high as 1,500 F. It is expected to cost about half the price of solid stainless. Stainless surface formed is integral with base material.

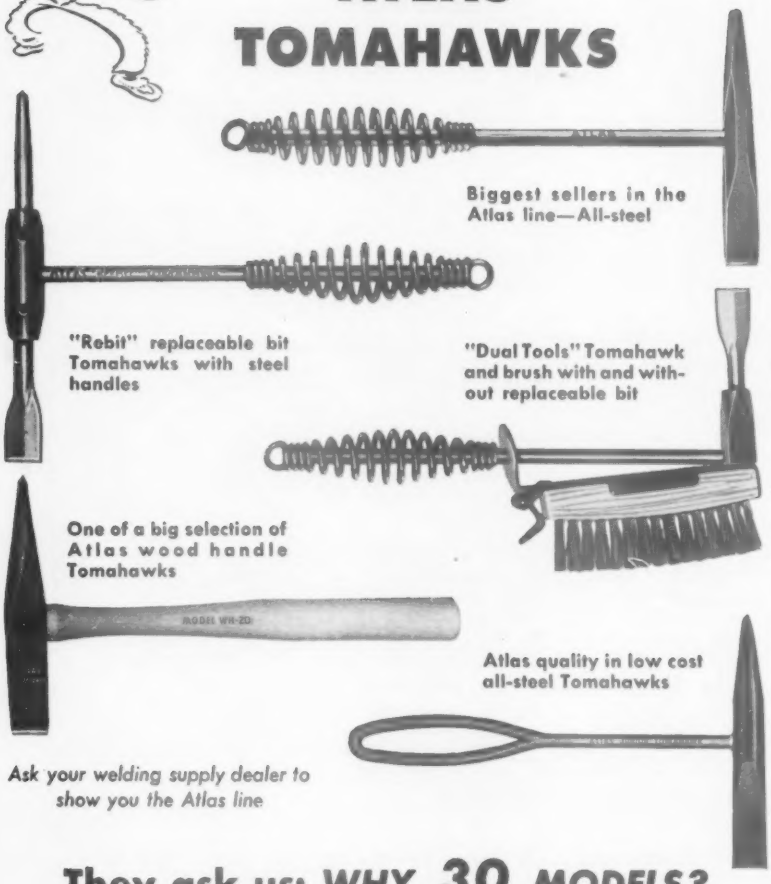
. . Another element has been born of the atomic age. It's nobelium, named after the Nobel Institute in Sweden. It was discovered by bombarding curium (element 96) with carbon ions accelerated in Nobel's cyclotron. Scientists from Sweden, U. S. and Great Britain joined in the research effort.



. . Linde Co. shortly will install bulk liquid-oxygen storage facilities for two more of its midwestern distributors. This will bring to three the number of such installations in the Midwest.

Tough! as they come

ATLAS TOMAHAWKS



Biggest sellers in the Atlas line—All-steel

"Rebit" replaceable bit Tomahawks with steel handles

"Dual Tools" Tomahawk and brush with and without replaceable bit

One of a big selection of Atlas wood handle Tomahawks

Atlas quality in low cost all-steel Tomahawks

Ask your welding supply dealer to show you the Atlas line

They ask us: *WHY* 30 *MODELS?*

We Answer:

—because weld cleaning jobs offer such a wide variety of problems—because welders have strong preferences for certain tool styles. Atlas has made a sincere effort to provide you with the tool you want regardless of your likes and dislikes, in ATLAS QUALITY!

ATLAS WELDING ACCESSORIES INC.

707 E. LEWISTON AVENUE, FERNDALE 20 (DETROIT) MICH.

Letter should be addressed to: The Editor, WELDING ENGINEER, P. O. Box 28, Morton Grove, Ill. No letter will be published unless signed, but your name will be withheld if requested.

Mid-June issue

Dear Sir: *San Francisco*

After thumbing through the Mid-June 1957 issue of the *Welding Engineer*, I personally feel that congratulations are again in order.

The various comparison and instruction charts, together with research material covering 1956 sales totals and the outlook for 1957, are certainly a helpful adjunct to anyone's activities, particularly in our welding industry.

Of course, the classified product section comes in for its portion of things that are good, too. The publication is getting better all the time. Keep up the nice work.

E. A. Daniels
Victor Equipment Co.

—and the heavier cover keeps our Fact File issue from becoming too dog-eared with use.

A pleasure

Dear Sir: *Los Angeles*

Our department library has two subscriptions to WELDING ENGINEER which are circulated to interested employees in the department of water and power.

It is always a pleasure to see the publication. May I congratulate you on the wonderful service you are performing for industry at large and those more directly connected with welding and the many welding processes.

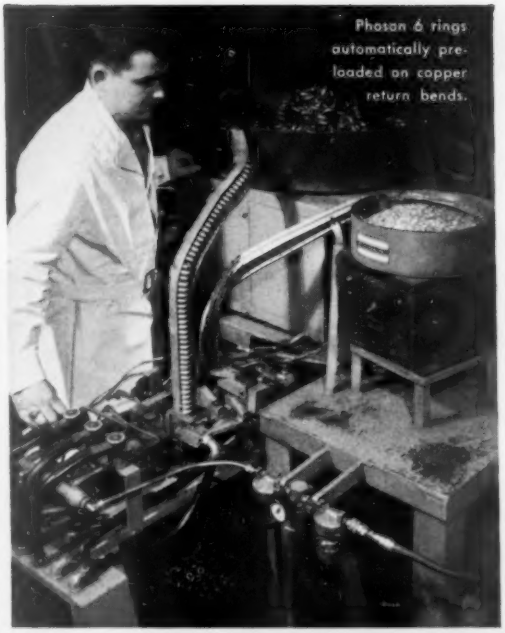
Clayton M. Allen
The City of Los Angeles

We goofed!

Dear Sir: *Appleton, Wis.*

All of us enjoyed reading the article "Tig—for the metal that 'couldn't be welded'" in the June issue of *Welding Engineer* until we got to page 36 where we saw the box entitled "These firms manufacture Tig welding equipment and supplies."

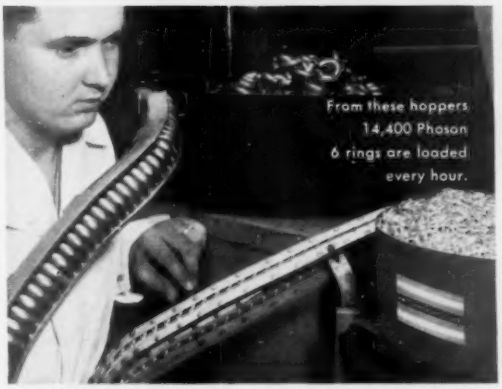
(Continued on page 19)



Phosan 6 rings automatically pre-loaded on copper return bends.

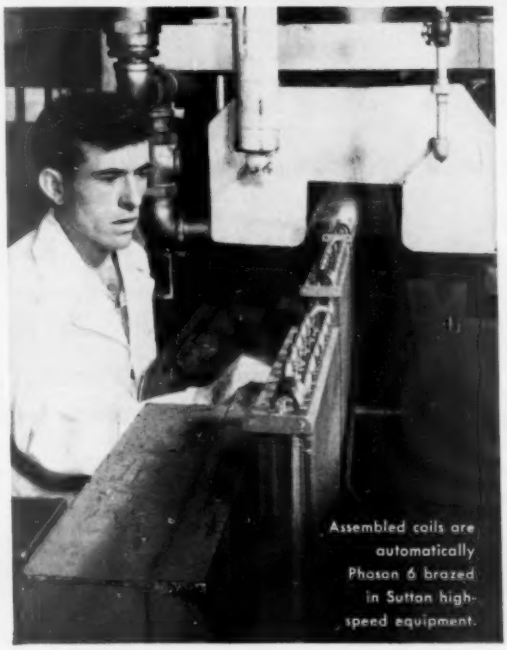
UNITED PHOSON 6 MAKES AUTOMATION IN BRAZING PRACTICAL... HIGHLY PROFITABLE

Brazing, too, can be fully automated. With the equipment shown, brilliantly engineered by The O. A. Sutton Corporation, up to 14,400 brazing rings are loaded every hour. Thanks to the high quality and precision tolerances of Phoson 6 rings, this company, one of the world's leading manufacturers of comfort cooling appliances, has increased assembly speed of copper return bends by 12 times!



From these hoppers 14,400 Phoson 6 rings are loaded every hour.

Phosan 6 rings provide the tight, slip-free fit automation demands.



Assembled coils are automatically Phoson 6 brazed in Sutton high-speed equipment.

To permit this amazing speed, brazing rings must fit tightly — perfectly — completely eliminating slippage prior to brazing. Here's how United Phoson 6 rings meet all the strict precision requirements of automation:

FIRST . . . Rings of Phoson 6 are preformed to exacting and uniform tolerance of +.000″ to −.005″ ID with a maximum helix of .015″.

SECOND . . . at the lowest practical temperature, Phoson 6 brazes leakproof joints of highest strength, ductility, corrosion resistance and thermal conductivity.

These two points add up to one fact. You can profit now from automated brazing! Without delay, get the whole story. Write direct to United or see your nearby United Welding Supply Distributor.

UNITED WIRE AND SUPPLY CORPORATION

PROVIDENCE 7, RHODE ISLAND

COPPER, BRASS AND ALUMINUM WIRE AND TUBE . . . BRAZING ALLOYS, PHOSON, SIL-BOND

A great new combination for your heavy weld grinding

44 ALUNDUM abrasive and B-11 resinoid bond form precisely balanced, economy wheels that bring you "TOUCH of GOLD" advantages*

In 44 ALUNDUM abrasive you get a recent Norton development that's a big step forward in quality-plus-economy.

"44" is non-premium priced . . . it's made differently, for extreme toughness and ruggedness . . . it performs better than other non-premium priced aluminum oxide wheels, cutting faster, grinding cooler and lasting longer . . . it's job-proved in 1100 different tests made in plants, welding plants included, throughout the country.

In the new B-11 resinoid bond you get added processing advancements that step up performance-benefits in your heavy weld grinding.

B-11 wheels are more uniform in structure and better balanced . . . they "hug that work" closer, with less vibration and bounce . . . they're made to closest possible duplication, available in half-grade increments evenly spaced across the entire hardness scale.

For details on these typical "Touch of Gold" benefits that add up to lower cost weld grinding, better product appearance, less operator-fatigue and longer wheel life, contact your Norton Distributor. Or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries

W-1781

NORTON
ABRASIVES

Making better products... to make your products better

NORTON PRODUCTS:
Abrasives • Grinding Wheels
Grinding Machines • Refractories

BEHR-MANNING PRODUCTS: Coated Abrasives
Sharpening Stones • Behr-cat Tapes

View between the two 2250-ton compressors at Garden State Plaza.

*"TUBE-TURN" and "tt" Reg. U.S. Pat. Off.

Piping that helps
AIR CONDITIONING
PAY OFF

● Air conditioning has become a giant industry because it provides valuable *user benefits*...more customers, increased working efficiency, greater profit.

Tube Turns is proud to be associated with this growing business, giving it assistance in piping engineering and supplying the top-quality, welded-piping fittings essential for dependable air conditioning systems.

More than 12,000 TUBE-TURN* products are available from your nearby Tube Turns' Distributor for *all* your needs in welded piping of *all* kinds.

AIR CONDITIONED. Buildings alone for the new Garden State Plaza Shopping Center at Paramus, N. J., cover 10 acres. Two 2250-ton compressors provide for the air conditioning system. All welded piping with TUBE-TURN fittings ranges from ½" to 18" diameter. Architect-Engineer: Abbott, Merkt & Co.; General Contractor: Joseph L. Muscarelle; Mechanical Contractor: Frank A. McBride Co.

The Leading Manufacturer of Welding Fittings and Flanges

TUBE TURNS
LOUISVILLE 1, KENTUCKY

A Division of National Cylinder Gas Company

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago • Detroit • Atlanta • New Orleans • Houston • Midland
Dallas • Tulsa • Kansas City • Denver • Los Angeles • San Francisco • Seattle

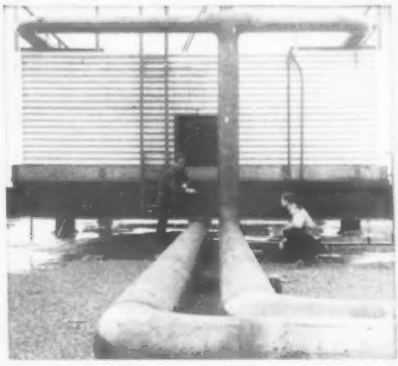
In Canada: Tube Turns of Canada, Ltd., Ridgetown, Ontario • Toronto, Ontario • Edmonton, Alberta

WHY IT PAYS

Why it pays to specify TUBE-TURN® Fittings for

AIR CONDITIONING PIPING

ELIMINATES GUESSWORK. Workers know they are getting the proper fittings as called for on the blueprint because TUBE-TURN fittings are completely and permanently identified as to dimensions, schedule and material.



FASTER INSTALLATION. Rigid inspection and quality control insure absolute uniformity of TUBE-TURN products...as to size, circularity and wall thickness. Above: Cooling tower for Bergen-Mall Shopping Center, Paramus, N. J. Photos courtesy Frank A. McBride, Paterson, N. J., mechanical contractors.

FOR SOUND ENGINEERING. You can specify TUBE-TURN* Fittings and Flanges and *know* you'll get the *right* product, without compromise. For example, you can get TUBE-TURN wrought iron fittings such as used for these condenser water lines in State Capitol Building, Harrisburg, Pa. Contractors: Riggs Distler & Co., Inc.

CUT RED TAPE. Tube Turns' line includes more than 12,000 standard welding fittings and flanges. All are available promptly from your nearby Tube Turns' Distributor. You can fill all your needs with one order to save purchasing manhours. Photo courtesy McJunkin Corporation, Charleston, W. Va.

HELPFUL DATA—This new Tube Turns' booklet gives helpful information on pipe, fitting and flange materials. Mail the coupon for your free copy.

TUBE TURNS, Dept. N-5
224 East Broadway, Louisville 1, Kentucky

Company Name _____

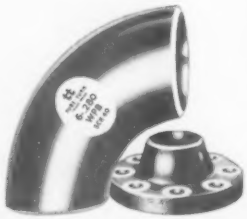
Company Address _____

City _____ *Zone* ____ *State* _____

Your Name _____

Position _____

Available now from your nearby TUBE TURNS' Distributor



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In Canada: Tube Turns of Canada Limited, Ridgetown, Ontario • Toronto, Ont. • Edmonton, Alberta

*"TUBE-TURN" and "tt" Reg. U. S. Pat. Off.

TUBE TURNS

LOUISVILLE 1, KENTUCKY

A DIVISION OF NATIONAL CYLINDER GAS COMPANY

What happened to the name of Miller Electric Mfg. Co.?

It would appear that we're obvious by our absence.

This article should receive quite a bit of attention from your readers and they may take the list given as gospel.

C. B. Abel
Miller Electric Mfg. Co.

Dear Sir: *Detroit*

We have noted with interest the last issue of your publication.

You have a very good complete feature story on arc welding. There is only one big trouble. You have omitted Weltronic Company from the list of companies that offer this type of control.

Wm. H. Smith
Weltronic Co.

Dear Sir: *St. Louis*

I note that in the June issue on Tig welding you list "Firms that manufacture Tig welding equipment and supplies." This tabulation makes no mention whatsoever of our equipment.

V. V. Netch
Vickers Electric Div.

—We apologize to any firm whose name was inadvertently omitted.

And some kind words

Dear Sir: *Chicago*

For some time I have intended to tell you how much I enjoy your editorials in the *Welding Engineer*. I particularly like the one in the July issue. It is appalling to think that most of this change in thinking has come about in the past 25 years.

Glenn Paxton
Campbell, Miller, Carroll
& Paxton Law Offices

Dear Sir: *Savannah, Ga.*

I certainly want to express my appreciation for all the assistance your publication has given me. The information has been a great help in attempting to evaluate the southeastern welding industry, in which we are interested as a market for industrial gases.

Robert H. Farrow
Southern Nitrogen Co., Inc.

Those houses again

Dear Sir: *Auckland, New Zealand*

Over the past two years, you have published a number of articles pertaining to steel frame houses. These have covered points of design, methods of wall fixing, a comparison in costs with wooden frame houses and also labor and material contents.

We are most interested in this subject . . . could you let us have other information on the subject?

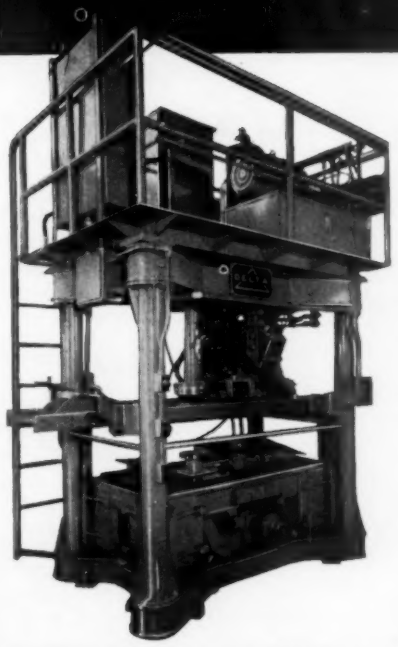
A. J. Banning

HIGH PRODUCTION RESISTANCE WELDING

DELTA

WELDER CORP.

MACHINES AND EQUIPMENT



High production resistance welding equipment and automation devices . . . designed, engineered, and manufactured by Delta Welder . . . that's the "know-how" which assures lower production costs and improved product quality!

The record of outstanding performance compiled by Delta Welder equipment and automation devices is worth your examination.

Permit our sales engineers to show you Delta Welder equipment developments and machines that are saving time and money for nationally known manufacturers. Write or call. No obligation. Ph. Texas 4-8446.

DELTA WELDER CORPORATION

8525 Livernois • Detroit 4, Michigan

They're wearing

Bay State abrasive engineer Don Kennedy put in enough years in the Navy to learn about rust removal and other grinding jobs the hard way. That's one reason why he's so useful to his customers and their operators . . . he knows what they're up against.

his "hat" wheels* and they wear well

When Bay State's now-famous "hat" wheels* were introduced at a large East Coast Shipyard, they caused something of a sensation. Here were revolutionary new grinding wheels that tore off metal like cup wheels but were much less heavy . . . that handled as easily as coated abrasive discs but cut faster, lasted longer and did more work at lower cost.

With today's increasing emphasis on welded construction, the outstanding performance of Bay State "hat" wheels is more important than ever. But prompt, intelligent service is important, too, and sales engineer Don Kennedy not only works with top supervisory personnel, he gets out on the job with the operators and really digs into their problems. Whether it's grinding welds on a super-tanker . . . smoothing up propeller castings for a new destroyer . . . or taking mill scale off a Texas Tower, his first-hand knowledge is backed by the most complete line of weld-grinding wheels on the market.

As a result, Don Kennedy's recommendations are practical and specific . . . Blue Flash for speed and heavy stock removal . . . Bayflex to resist loading on soft metals . . . Saf-T-Cut for longer life on hard, jagged surfaces . . . DuraCut for blending and finishing broad areas.

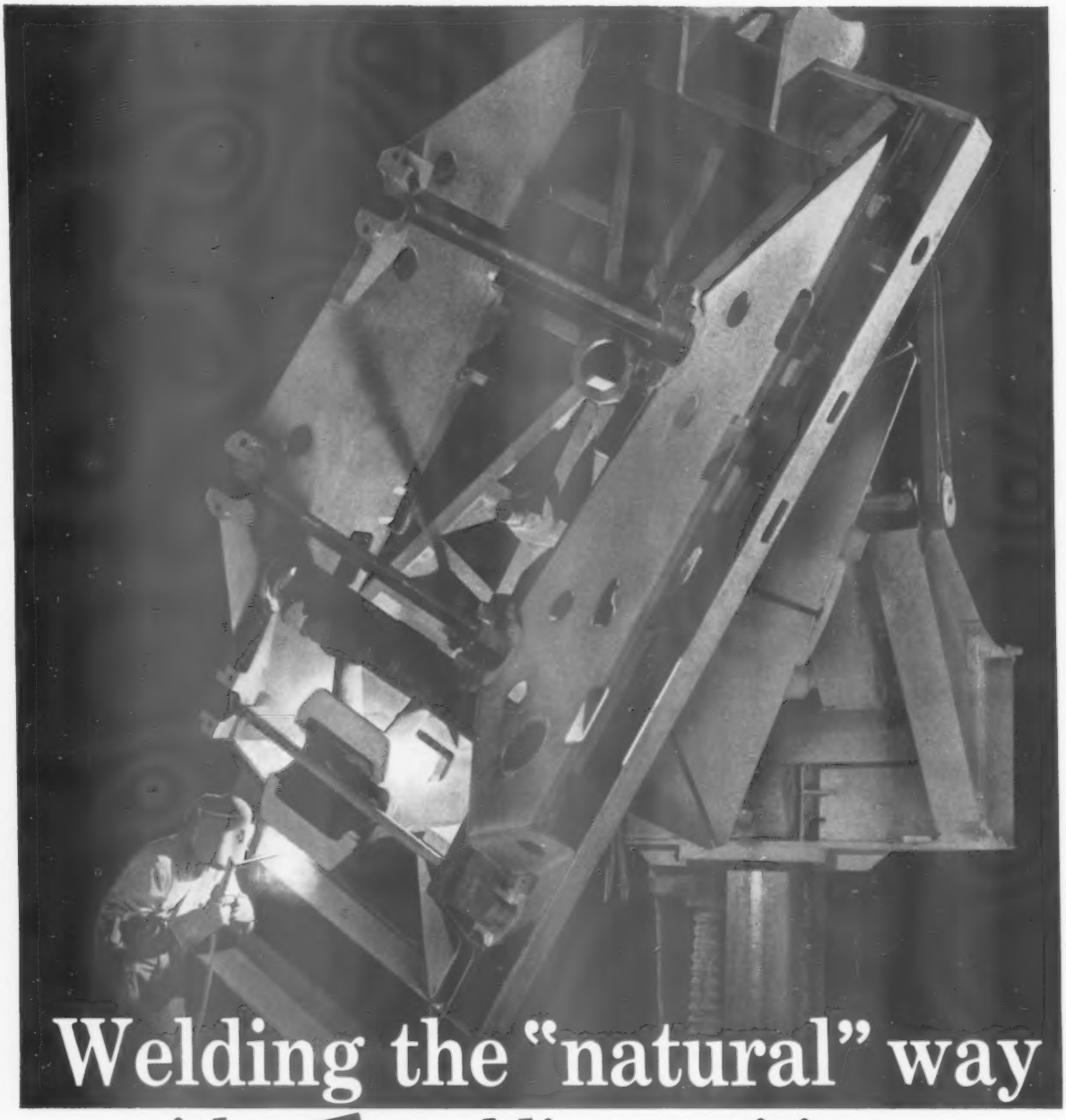
Whatever your company's grinding problems may be, you'll find Bay State representatives like Don Kennedy ready to help and competent to work out practical solutions.

**Raised hub disc wheels, reinforced for extra safety*

BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Mass.
Branch Offices and Warehouses: Bristol, Conn., Chicago, Cleveland, Detroit, Pittsburgh.
Distributors: All principal cities. Bay State Abrasive Products Co. (Canada) Ltd., Brantford, Ontario.



Welding the "natural" way with P&H welding positioners

Downhand welding is faster, easier, more economical. And P&H Welding Positioners enable your weldors to quickly and easily position their work for faster welding in the downhand — the *natural* — position.

Downhand welding also permits the use of hotter, faster electrodes. Penetration is much better, welds are smoother, neater, more uniform.

By simply pressing control buttons, the weldor safely positions pieces as heavy as 100,000 pounds for maximum comfort and speed of welding. Worker efficiency goes up — and so does your production!

What's more, labor and overhead — the vital factors that cost you 86¢ out of every welding dollar — can be cut in half by using P&H Positioners for weldment handling.

Investigate P&H Welding Positioners. Write to Dept. 320B, Harnischfeger Corp., Milwaukee 46, Wisconsin.

HARNISCHFEGER

P&H WELDERS • ELECTRODES • POSITIONERS

MILWAUKEE 46, WISCONSIN

BETWEEN PASSES

non-destructive special

This August issue of *Welding Engineer* is dedicated to a phase of our industry too often neglected—non-destructive testing of welds. A quality control program is predicated on the use of some *reliable* means of inspection. This edition presents to you those methods most commonly used. If you want extra tearsheets of any of the articles, just drop us a line.

we're well known

In the metal-working industry, *Welding Engineer* is known far and wide, but we weren't aware of our influence in the post office . . . especially in Boston. Seems a letter erroneously addressed to us in a Beantown building was forwarded directly to Chicago.

"AFTER the game he played yesterday, he decided to give his clubs to Junior."

ultrasonics

Ultrasonic welding was cited as a potential growth field for ultrasonics at recent seminars sponsored by the Industrial Education Institute. Aluminum and other lightweight metals can be joined with such equipment, and joining of dissimilar metals is predicted for the near future.

old stuff

A reader in Florida throught he came across something novel when he heard that horseshoes were being hardfaced with tungsten carbide, so he dropped us a card to that effect. Shucks! Mr. Landauer, that's old hat . . . been done for years.

people's capitalism

Many peoples throughout the world feel a bloated, distorted image of capitalism waves with the Stars and Stripes. The United States' economic system (the Advertising Council calls it "people's capitalism") is widely misunderstood, abroad *and* in this country. To try to clear up this misunderstanding somewhat, a group of Yale University professors and business and labor leaders recently got together. Yale and the Advertising Council sponsored this "American Round Table." One interesting conclusion: The U.S., the one great industrial nation that "clings most tenaciously to private capitalism, has come closest to the socialist goal of providing abundance for all in a classless society."

training aid

The world being what it is, we were scarcely surprised, while browsing through the list of handbooks published by the National Bureau of Standards, to find an article with the restrained title: *Safe Handling of Cadavers Containing Radioactive Isotopes*. We realize the importance of being an informed citizen in this time of trouble, but we're not going to make that an indispensable part of *our* library. Kiddies might get at it. And you know how *they* are. . . .

go west

Looks like another of our industry's conventions is heading west in 1960. The International Acetylene Association is expected to meet in Seattle three years from now. The AWS convention and welding show are rumored heading for the coast in that same year. NWSA meets in San Francisco in 1959.

sea stories

We see that the Navy's Bureau of Ships has expressed interest in "war episodes of World War II and the Korean War . . . interestingly related, particularly if told in the first person . . . manuscripts can be submitted to the Chief of Information for evaluation, comment, and/or assistance in possible placement." Pull out your quills, men, now's your chance to get paid for all those sea stories you've been telling over the years.

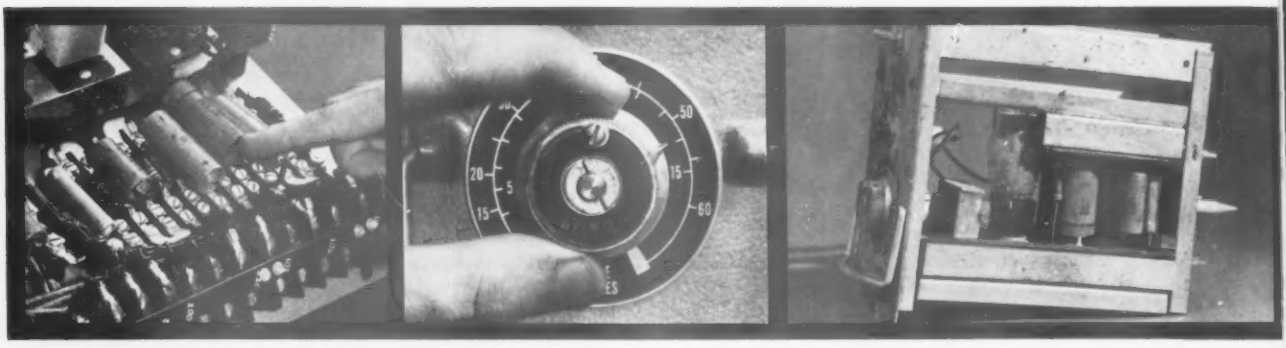
licensed weldors

A bill to license weldors was allowed to die a natural death in the Illinois state legislature several weeks ago. It proposed that all welding "shall be performed by weldors licensed by the Department of Registration and Education." The proposed law would have created a board of welding examiners to hold tests for applicants. A $15 fee would be required, with a $10 annual renewal.

remember . . .

August is National Sandwich Month; Aug. 8 is International Character Day; Aug. 25 is Temperance Sunday.

NEW G-E RESISTANCE-WELDING CONTROLS come in two lines to meet *any* non-synchronous application. *Standardline* combinations—using standard NEMA sequence timers—are specifically for normal welding applications. *Customline* combinations use unit timers to provide any control sequence needed on special-purpose, multi-electrode, or automated machines.



4 **DELAYED FIRING** allows G-E control to be used in many jobs where synchronous control is normally required.

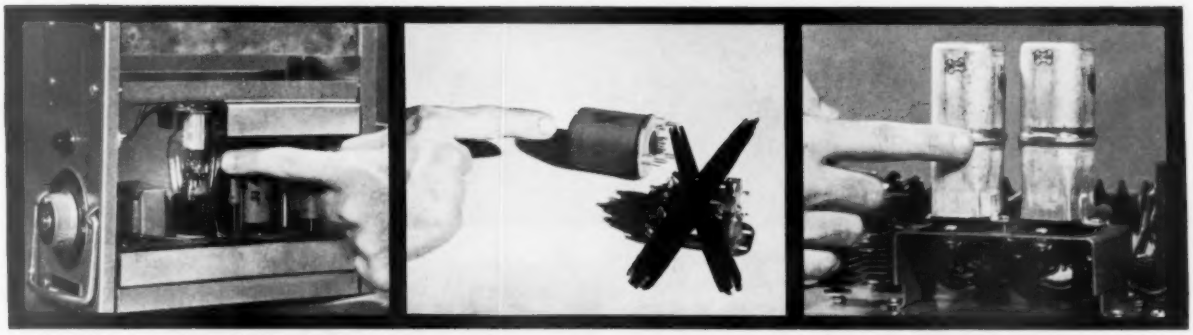
5 **EXPANDED CALIBRATION**—assures accurate setting of short time cycles for more consistent welding results.

6 **RUGGED DESIGN** gives optimum resistance to adverse conditions such as dirt, dust, moisture, and vibration.

Specify General Electric's NEW *cost-cutting* non-synchronous controls for your next resistance-welding application. For more information, write to Section 794–4, General Electric Co., Schenectady, N. Y., for bulletins GEA-6408 (Standardline) and GEA-6593 (Customline). *Specialty Control Dept., Waynesboro, Virginia.*

7 REASONS WHY GENERAL ELECTRIC'S NEW NON-SYNCHRONOUS CONTROLS PROVIDE

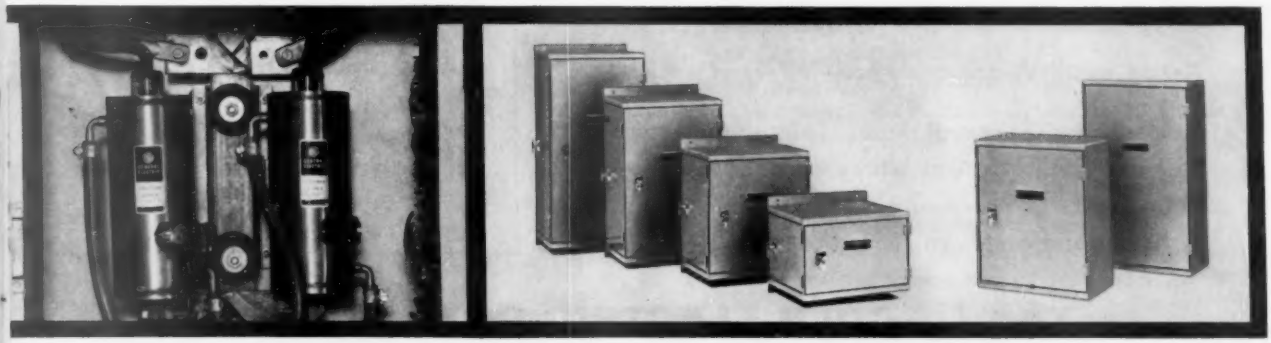
High-quality welds ...time after time!



1 **WELD-SAFE OPERATION** protects weld fixtures; weld-timer failure will shift control to the next timer in sequence.

2 **HERMETICALLY SEALED RELAYS**—A G-E exclusive—give functional accuracy, long life, consistent welds.

3 **SYNCHRONIZED OPERATION** of weld relay assures consistent timing, results in welds of uniform quality.

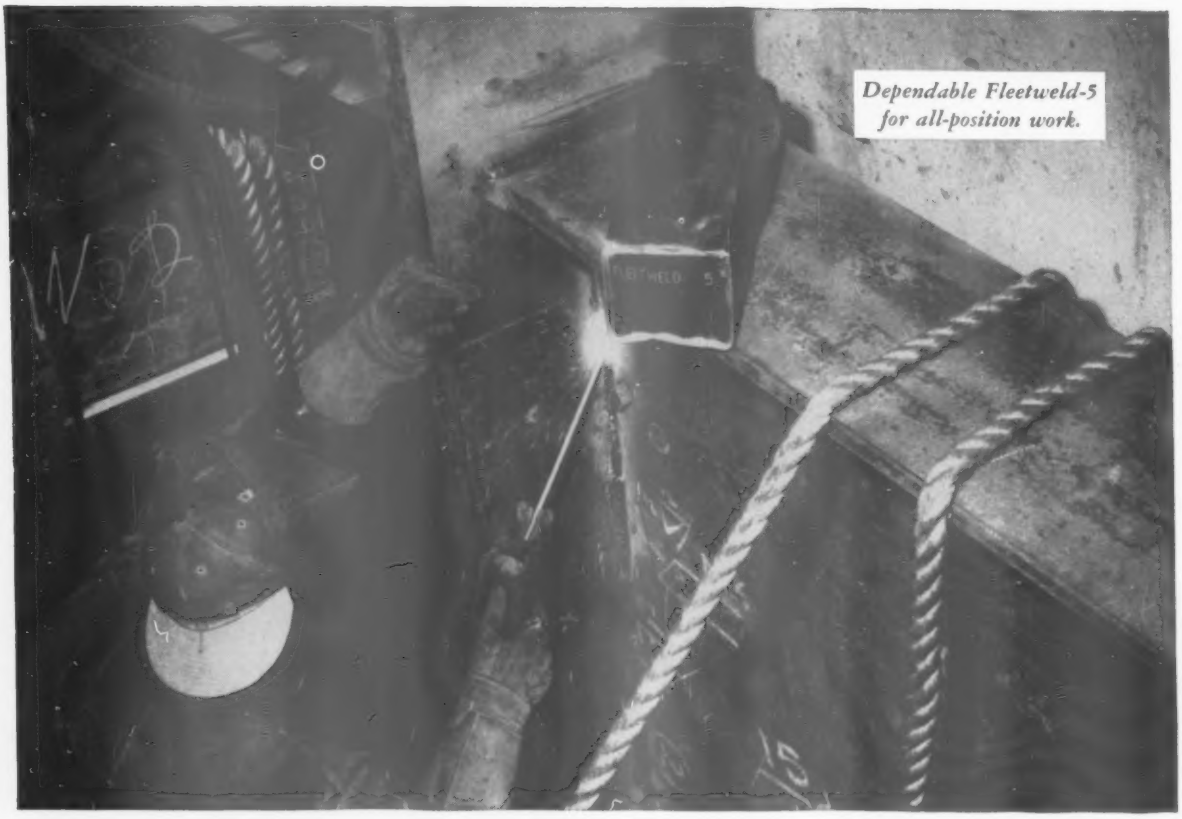


7 **FAST, ACCURATE IGNITRON CONTACTORS** provide dependable switching—free from mechanical failure.

FULL-LINE SELECTION—choice of 4 control cases and 2 contactor cases—means you can buy for present and future needs. "Building-block" design gives maximum flexibility for assembly of combinations, a simple way to add control.

Progress Is Our Most Important Product

GENERAL ELECTRIC



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WHY use anything but Fleetweld-5?

AUGUST, 1957

Welding Engineer

ESTABLISHED 1916

Utilize your "wasted" time

Is THE YEAR passing too rapidly for you? Time flies when you're busy—or if you are getting older. It's our most valuable commodity, yet how often do we see time being wasted?

How often do we walk through a plant and see employees operating at a snail's pace when there are literally hundreds of jobs waiting to be done? And how often do we spot highly-paid executives performing jobs that could be equally well done by $60-a-week clerks? These situations are not uncommon, even in today's high-pressured industrial organizations.

The person who makes efficient use of all his time hasn't been born yet. Chances are, there will never be such a person, for a certain fraction of our waking hours must be "wasted" in leisure pursuits if we want to retain a wholesome outlook. It is important, however, that these hours be kept to a sensible minimum during the greatest part of each year.

Before we know it, this year will be over. Some will look back on it and acknowledge the fact that it was a waste of time. But the very act of making such an admission won't prevent certain persons from wasting even more time in the future.

The Bible has estimated man's time on earth at "three score years and ten"—a relatively short period. But wouldn't the future for the welding industry shine even more brightly than it does now if all of us converted just our *wasted* time into promotion for our industry?

AT MID-YEAR, indications are still strong that customers in 1957 will spend more than $1,000,000,000 for welding supplies, equipment and gases. If we had wisely spent the time that was wasted in the past few years, this sales figure might now be climbing past the $2-billion mark.

In what way can you help the welding industry? Actually, there are unlimited means at your disposal, and almost as many areas in which your voice will be heard.

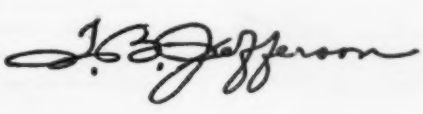
In six short weeks, student engineers will be returning to colleges and universities to continue their education. How about paying the institutions in your area a visit? Point out to some of these students that their course of study should include welding—the modern joining process.

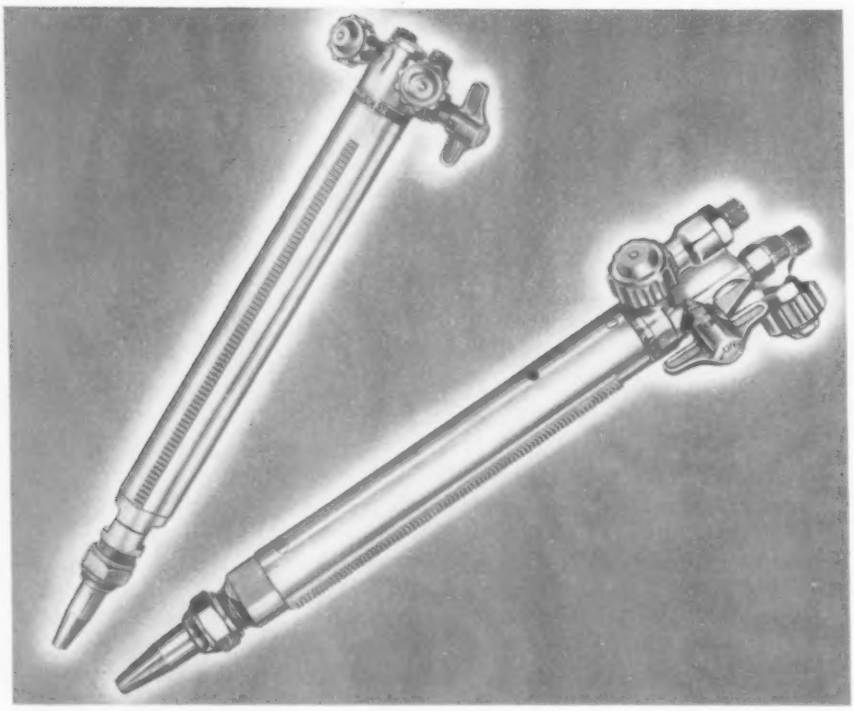
WOULDN'T it also be a good idea to take a further step and discuss welding's growth and future promise with students on the high school level? If these young men want to devote themselves to the study of engineering or science in college, they must start their preparations now. And it's up to you to see that high schools in your community provide such students with a proper background in mathematics and science so that they may pursue technical courses in college.

Too much time is being wasted by our nation's youth on the college level because of inadequate primary and secondary-school education. If those of us who profess a deep-rooted interest in welding had utilized *our* wasted time, perhaps the welding industry today would not be handicapped by a serious shortage of welding engineers.

Closely allied to this suggestion for proselyting students is the equally important task of searching out good engineers who are doing anything *but* engineering work. Again, it's a job in which all of us can participate.

Let's find these engineers who are now doing the work of technicians—or office managers—and tell them why welding needs their help. Let's point out that they are wasting time that could profitably be spent in helping everyone enjoy better and stronger products through increased welding usage.





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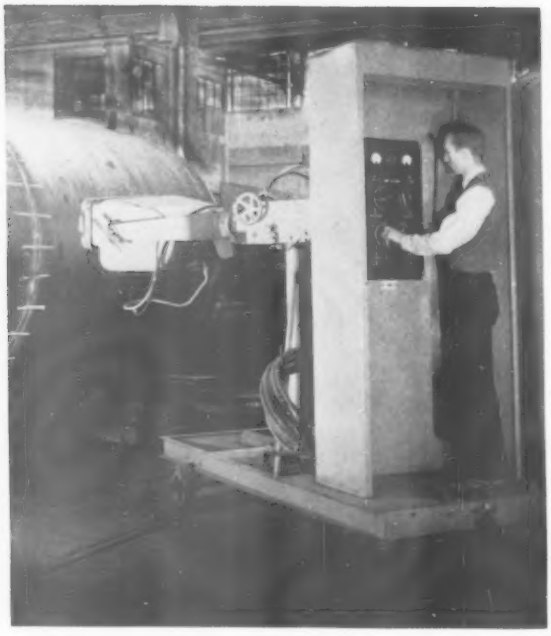
NON-DESTRUCTIVE TESTING

When production costs skyrocket,
profits go
down.
Product quality cannot be slashed. Prices cannot leapfrog. What is the answer?
Part of it is non-destructive testing—
inexpensive assurance that production errors are spotted and corrected before rejects stockpile.
With this in mind, WELDING ENGINEER has devoted nine articles in this issue to methods of non-destructive inspection and how they can help solve your problems.

Thorough testing
without
loss of product . . .



The evolution of economy in testing metals

By Jack Fairlie

WHEN Wilhelm Konrad Roentgen set up an experiment to determine whether cathode rays in a vacuum tube contained ultraviolet or other invisible light forms, he didn't expect to uncover mysterious "X" rays.

But he did—and, in so doing, laid the groundwork for the field of non-destructive industrial test procedures that we now term *radiography*.

Roentgen, a professor of physics at Bavaria's Wuerzburg University, was simply trying to improve upon results obtained in tests conducted by others over the previous 200 years. These early technicians had noted a phosphorescent glow when electricity was discharged in an evacuated tube.

A "Long-Range" Glow

Covering a cathode-ray tube with a black paper case, Professor Roentgen then deposited barium platinocyanide crystals on cardboard. He knew that if no visible light were penetrating the tube case, a greenish-yellow glow on the cardboard would prove that invisible light radiations were being emitted.

When the professor darkened the room to make sure that no light was escaping from the covered tube, he was amazed to see the screen—which was lying 10 or 12 ft from the tube and had not yet been placed in test position—glowing brightly.

The startling fact was not that the screen glowed—he had expected it to do that—but that the glow had such intensity at a great distance. It was not the work of a few ultraviolet rays, he knew. It was the result of a bombardment by unknown "X" radiations.

The news of Roentgen's discovery spread quickly and resulted in many simultaneous investigations.

But it was Roentgen again who discovered that the unknown radiations resulted from cathode-stream impingement upon almost any object, but mainly from the anode.

In his initial development work, the professor noted with wonder that these X-rays could penetrate apparently solid matter; that their powers of penetration increased as greater voltages were fed to the cathode tube, and that the radiations could produce a shadow image on sensitized photographic plates.

These were the foremost contributions of Roentgen. With the coming of a new century, X-ray development became fair game for literally thousands of physicists.

Until 1912, the efforts of everyone connected with X-rays to suit the process to the demands of industrial testing went by the boards. In dentistry, surgery and medicine, radiography performed in an acceptable manner. But tubes similar to those used in these fields broke down when subjected to higher voltages.

When Friedrich, Knipping and Laue announced that

X-rays were diffracted by crystals, however, progress in industrial radiography became more than a possibility. Up to this time, X-radiations could not be diverted. The result was a straight-line electron stream that indicated, on film, only metal imperfections.

Electron beams, channeled through a thin crystalline specimen, were deflected by the atomic arrangement of the piece, and by tiny crystals. The pattern made by these diffracted beams when they impinged on film indicated clearly the molecular structure of the specimen.

By virtue of this X-ray diffraction method, scientists today can determine suitability of weld metal for any application.

The Coolidge Tube

The result of another line of research also was announced in 1912—an X-ray tube that could take higher voltages, and operate steadily for longer periods of time.. Inventor Coolidge pointed out that the tube increased both penetrating power and intensity of X-rays —and that both characteristics could be independently controlled.

World War I gave the X-ray process its first severe trial. Results—though sometimes inconclusive and occasionally inadequate—were generally acceptable. Wooden aircraft parts and metal components for shells were commonly inspected.

More importantly, the war emergency gave impetus to X-ray development for industrial applications that resulted in the postwar production of a 200,000-volt Coolidge tube. Steel up to 3 in. thick could be inspected *under production conditions* with this unit.

In 1924, the country's first 1,200-psi steam pressure power plant was inspected with this high-voltage tube.

In 1929, the U. S. Navy made X-ray inspection mandatory on welded boiler drums.

In 1931, the ASME Boiler Code was amended to permit welded construction of pressure vessels for the most severe service *if the welded seams were radiographed.*

During the 1930's, rapid improvements in equipment and techniques continued to be made. New units introduced during this period included both a 300,000 and 400,000-volt Coolidge tube (the latter with a current of 5 milliamperes). These tubes raised maximum possible inspection thicknesses to 4½ in. for steel, and to even greater thicknesses for less dense materials.

The portable X-ray unit made its appearance in the mid-30's, due to improvements in high-tension cables which could carry loads up to approximately 200 kv.

But radiographic film producers held back until 1939 before turning out film types designed solely for industrial test purposes. Prior to this time, industrial laboratories had to content themselves with the inadequate performance of medical X-ray film.

Again, it was a war that prompted the type of all-out development so necessary for the continued industrial value of the X-ray process. And it was also World War II that gave birth to radically new means for employing a non-destructive test method contemporary with X-radiation.

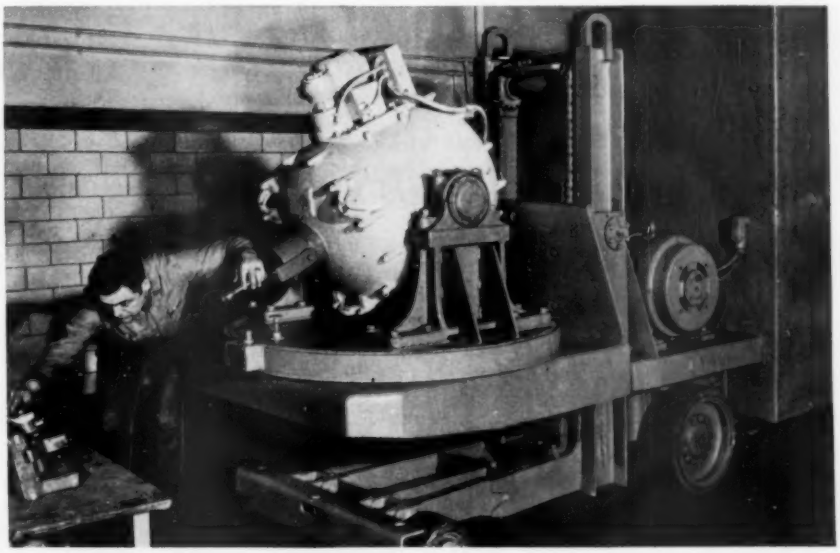
Equally Effective

The untiring efforts of Pierre and Marie Curie in their successful attempt to isolate the element radium gave rise to the industrial test process called *gamma-ray* inspection.

Conducted at virtually the same time Professor Roentgen made his startling discovery, the Curies' experiments indicated that radium emits three radiations: alpha, beta and gamma rays. Only the latter, however, have true electromagnetic oscillations with a velocity equal to that of light.

That radium's gamma rays could produce a radiographic image was known as far back as 1896, when Henri Becquerel transferred the image of an aluminum medal to a photographic plate wrapped in black paper. But it was not until the early 30's that Dr. Robert Mehl of the U. S. Naval Research Laboratory worked out a program for the gamma-ray inspection of weldments and castings.

The rules which Dr. Mehl formulated to cover his activities over 20 years ago are still valuable today



RADIOACTIVE cobalt 60 is used in this unit, and makes it capable of inspecting steel up to 7 in. thick. Developed at Babcock & Wilcox Co.'s Barberton, Ohio, plant, unit requires only one-third of exposure time of million-volt X-ray machine.

VISUAL inspection, with the aid of a strong light and magnifying lens, is limited by eye's ability to spot very fine cracks, and inability to see sub-surface cracks.

wherever radium is used in industrial testing.

The Atomic Age

With the achievement of nuclear fission in 1942, however, need for hard-to-get radium decreased. Cobalt was radioactivated and, although slower, the product called *cobalt 60* produces effects similar to those of radium.

The rare element iridium—which resembles in many respects the popular platinum so commonly used by early radiographers—also received successful radioactivation treatments and, as *iridium 192*, is now employed as a practical substitute for radium.

Industrial gamma radiography recently added a newcomer to its line-up of useful radioactive materials. The AEC's Argonne National Laboratory approved the release of *thulium 170* for use by private firms. Energy of this material is comparable to that of an 80-kv X-ray tube.

Of all the processes presently in service for nondestructive testing of weldments and castings, radiographic methods lead the field in popularity.

What are the remaining non-destructive test methods?

Generally, they can be listed under the headings of visual inspection, thermal tests, magnetic particle and penetrant inspections, pressurized leak tests, electrical resistance methods, eddy current tests, and ultrasonic inspection.

For as long as man has joined metals by some welding method—or has cast forms from molten metal—visual inspection has assumed an important role in nondestructive quality control of materials.

The cheapest of all inspection devices, the human eye can perceive a great many surface defects—particularly when it is aided by lenses, microscopes, boroscopes and *the best possible lighting*. Naturally, eyes are unreliable when subjected to long hours of inspection, so this elementary test method must be limited in the length of its application.

But there is another and more important limit to the capacities of human vision. Surface cracks can be so fine that they escape the notice of even the keenest eyes. Taking over where the eye must leave off are the other non-destructive test methods cited above.

In the late 20's, A. V. de Forest developed and perfected a "magnetic dust" test method which he successfully applied to oil well drill pipe. We know this process today as *magnetic particle* inspection, and it can locate cracks in welded joints even more quickly and surely than it did in 1929.

This particular inspection method utilizes magnetized particles which are applied in a dry or wet-suspension state to a workpiece in which an intense magnetic field has been set up. Cracks or other discontinuities interrupt the magnetic field and align the magnetic flux along edges of such cracks. The leakage fields, then, are actually local magnets which indicate their presence by holding particles at their edges.

Penetrant Inspection

Indicating surface imperfections in much the same manner as do magnetic particles, the dye and fluorescent penetrant methods utilize capillary action rather than a magnetic field.

Applied to a clean surface in a liquid state by brush, spray or immersion, the penetrant is given time to find its way into even the finest cracks. Excess penetrant is then wiped from the workpiece and a developing fluid is spread on the surface. This material draws any penetrant material remaining in cracks to the surface and spreads it on either side of the cracks.

If the penetrant is a dye type, it is naturally colored and can be readily seen under ordinary white light. This type indicates imperfections by red dots or lines against a white background. Greenish-yellow lines or dots on a dark background are observed when using fluorescent penetrants.

Ever since man first filled a container with liquid to gage its soundness, the world has known a form of leak testing. Only in very recent times, however, has this time-honored method been developed into a science.

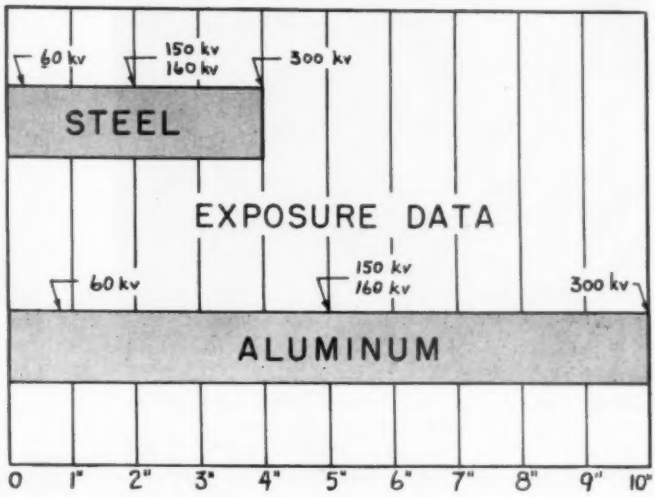
Water is still a popular medium for leak testing. But, in addition to the hydrostatic method, metals may also be tested by the use of fluorescent or radioactive liquids and gases, and by such gases as helium, freon, ammonia or sulphur dioxide.

Probably the most sensitive of all leak tests is that which utilizes a detector sensitive to halogen gas. Nat-

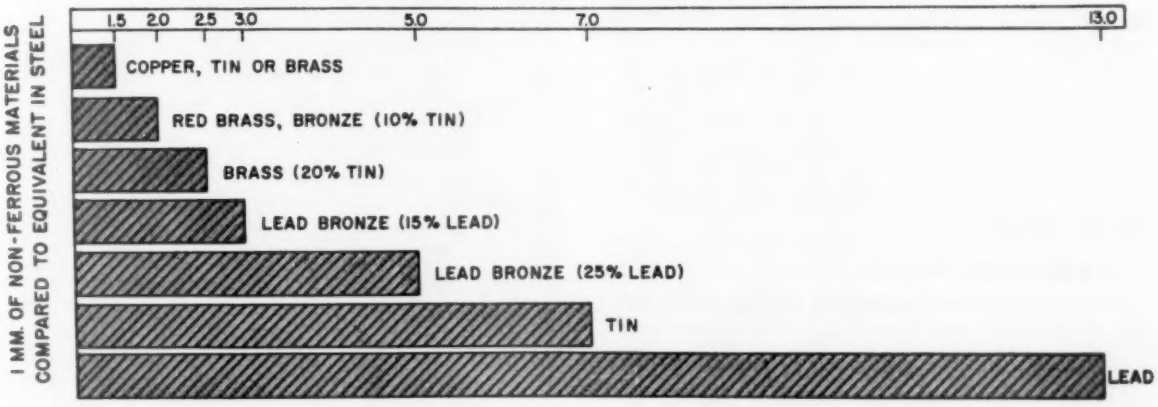
MAGNETIC particle inspection method is employed on turbine casting. Probes set up magnetic field and squeeze bottle in operator's right hand sprays particles over area. They will mark location of defects.

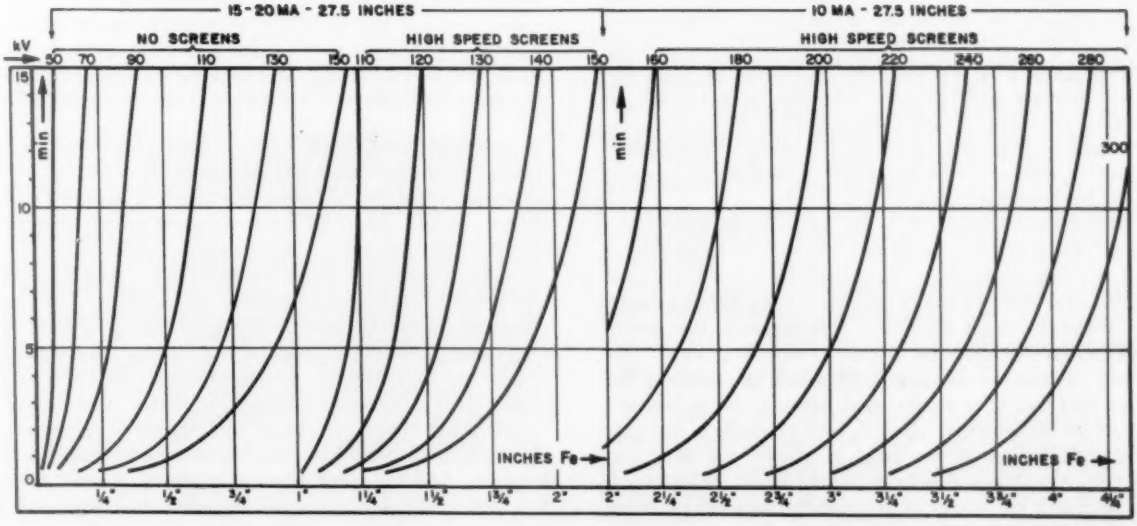
X-ray exposure data

The graph at right indicates recommended industrial X-ray unit ratings for penetrating various steel and aluminum thicknesses. The chart below helps determine penetration values of various alloys and metals, using the penetration value for steel, measured in millimeters. The graph at bottom provides exposure data for penetrating steel; kilovoltage, thickness, screens and times of exposure are given.



STANDARD VALUES FOR RADIOGRAPHS OF HEAVY METALS


1 MM. OF NON-FERROUS MATERIALS COMPARED TO EQUIVALENT IN STEEL
1.5 2.0 2.5 3.0 5.0 7.0 13.0
COPPER, TIN OR BRASS
RED BRASS, BRONZE (10% TIN)
BRASS (20% TIN)
LEAD BRONZE (15% LEAD)
LEAD BRONZE (25% LEAD)
TIN
LEAD



—Courtesy North American Philips Co.

REPAIRED valve seat in cylinder head is tested by filling water jacket with kerosene and using air at 90 psi. Any weld cracks will result in leaks.

urally, the gas placed under pressure in the part to be tested must contain chlorine, fluorine, iodine, or any of the nonoxygenated radicals. A halogen-sensitive detector will note the presence of one part of such gas in one million parts of air.

Mass spectrometer detection in conjunction with helium is another sensitive set-up that will detect one part of helium in 200,000 parts of air.

There are numerous methods for applying leak detection tests. When working with helium, for example, the user may place a leak detector inside a vessel and literally spray the vessel's exterior wall with helium under pressure. Or, he may fill the vessel with helium and use a "snifter" connected to the leak detector to scan the exterior walls.

Two Uncommon Methods

Two non-destructive test methods employ electric current to determine metal soundness, and both have only recently been developed to the point at which a high degree of accuracy can be obtained.

Thermal tests are normally conducted with the aid of temperature-indicating substances (crayons, paints, phosphors), thermocouples or resistance thermometers. A test of this nature can indicate fairly conclusively those areas of a test piece which contain an imperfection, because such an area will heat more rapidly (it has a poor heat-transfer capacity).

Induction heating units, direct contact with electric current, or even ovens are common methods of creating heat for this type of test.

Electrical resistance tests are based on the simple fact that, when current is passed through a metal object of uniform dimensions, there will be a fixed potential difference between any two points a fixed distance apart.

When the metal object has a defect in it, this potential difference will be greater than that which has been determined as normal. However, accurate as the test may be, it is rarely used because the test object must be scrupulously cleaned, and pressure of the current-carrying electrodes must be exactly the same and evenly distributed if reliable results are to be obtained.

As man's knowledge of the potential uses for electrical current has increased, methods of non-destructive testing have also grown in number. One such test method arose from the discovery that an a-c coil in proximity to a metal piece will induce *eddy currents* in the metal.

Such currents lack the power to penetrate very far beneath the metal surface; whenever they drop to 37% of their surface value, eddy currents no longer give a good indication of soundness in the specimen.

When an a-c current has been induced in the metal test piece, it creates a magnetic field opposing that already in the metal. Impedance of the exciting coil is naturally affected by the eddy current that is set up, and whenever a defect exists in the metal, increased impedance can be measured.

Sounding Out the Work

Another of the modern non-destructive test methods with a long history of practical use in a more basic form is the *ultrasonic* process. The blacksmith who hammered finished work and listened for a clear ring was practicing a form of *sonic* testing. But fine cracks that even the smithy missed can be detected today with equipment that produces high-frequency sound waves.

A radio frequency generator is the natural source of necessary electrical oscillations, which must be converted into mechanical vibrations before entering a test piece. A quartz crystal will perform this transition, as will a barium titanate transducer.

When the ultrasonic beam with its short wave length enters metal, it will travel in a straight line. Unless it meets an object smaller than its own wave length, the beam will not be seriously reflected.

Some reflection will occur, however, when the ultrasonic waves encounter fissures (or any interface). To get the high-frequency sound waves from the transducer into the workpiece, therefore, it is necessary to employ a water or oil couplant to transmit energy.

The pulse/echo ultrasonic technique is a radar-like method for determining the presence and location of flaws. A beam sent into metal will be reflected from the opposite side of the piece; it will also be reflected by cracks or other discontinuities. The amount of time required for these reflected beams to return to the transducer is an indication of flaw location.

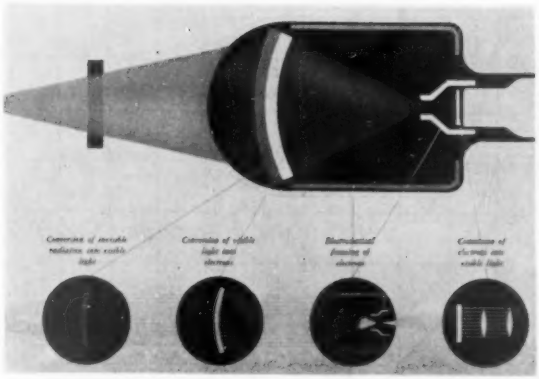
Another type of ultrasonic wave testing is the transmission method, in which a beam is sent through the workpiece and its energy is gaged upon emission. Loss of energy indicates both position and size of any defect.

. . . And the Future?

There are many variations and modifications of the non-destructive test methods described in this article. There are still other methods which were left unmentioned, either because they are falling into disuse or because they have only occasional value.

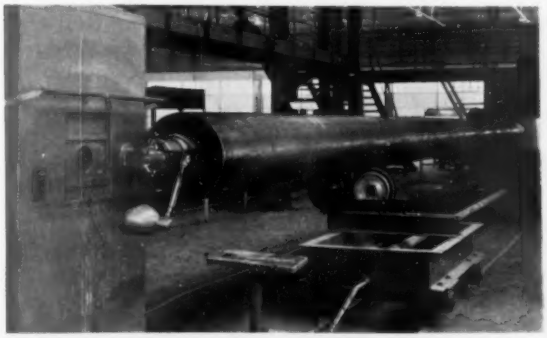
Even the listing that has been made may be radically changed during the next 10 years. Not only will new methods be made available; old processes will be updated until they scarcely resemble those we know today.

For every advance in fabrication techniques, it seems certain that there will be a test method capable of checking material soundness without destroying that material. And for every new or improved non-destructive test method, there will be additional time and dollar savings for U. S. industry.



MECHANISM of image intensification in electronic fluoroscopy is illustrated in cut-away sketch. Process eliminates need for X-ray film, but has not been accepted in certain industries.

ALTHOUGH being used here with film to inspect an array of 13 parts, this 360-deg X-ray tube may also be used for direct viewing.



WELDED steel piping provides ideal subject for electronic fluoroscopy. Pipe will move at 10 fpm past viewing booth at left.

Those who have studied a relatively new field of radiographic examination are asking this question:

Fluoroscopy . . . will it reduce the use of film?

RADIOGRAPHY has played a vital part in the successful application of welding techniques in diverse industries. Technical advances in equipment design have continually increased the value of X-rays, and great strides have also been made in film development.

But manufacturers of fluoroscopic equipment note that it is in the purchase of this film that large users of industrial radiography experience a continuing financial headache. It is not unusual, claim the fluoroscopy advocates, for a large fabricator to spend $100,000 a year on this important commodity, and a few aircraft manufacturers reportedly experience an approximate $1,000,000-a-year outlay for film.

Over and above the initial purchase price of X-ray film, the user must also consider associated problems of processing, filing and storage *(under the present ASME boiler code, some industries must preserve radiographs for a minimum of 10 years)*.

An Economical Solution

The search by certain manufacturers for an efficient way of conducting X-ray inspection while reducing or eliminating the need for film has resulted in many fluoroscopic adaptations. Use of fluoroscopy, however, was unsuccessful until recently because of the need for a darkened enclosure, the seemingly unavoidable dimness of the picture, and its poor detail. All these factors also contributed to operator eye fatigue.

With the development of an "Industrial Image Intensifier" by Philips Electronics, Inc., these circumstances have been largely alleviated. This device, used with an X-ray source and popularly known as an "electronic fluoroscope," produces an image 1,000 to 1,200 times brighter than that obtained with a standard industrial fluoroscope.

In addition to the Norelco unit, other machines with some form of image intensification are produced by Westinghouse, General Electric Co. and Bendix-Friess.

Principles of Intensification

An X-ray beam passes through the object being examined and through the glass wall of an evacuated cylindrical tube, until it reaches a fluorescent screen mounted in one end of the tube. This fluorescent screen transforms invisible X-radiation into a conventional fluoroscopic image.

The light of the image thus created frees electrons from the sensitive photocathode, which is in close contact with the fluorescent screen. On each point of the photocathode, the number of freed electrons per second is proportional to brightness of the fluorescent screen at that point, and to X-ray intensity.

In this way, the latent X-ray image—with all its variations in intensity—is converted into an electron image with corresponding variations in electron density.

Electrons freed from the photocathode are accelerated by the high voltage of an external power source applied between the photocathode and the open anode at the far end of the tube. The electron image is electrostatically focused on a fluorescent viewing screen.

This second screen converts the energy of impinging electrons into visible light. The image is far smaller than that on the fluorescent screen *(the diameter of the X-ray screen is 9 times that of the viewing screen)* —but image brightness is far greater.

Initially, electrons emitted by the photocathode have been accelerated by the applied high voltage, giving them greater velocity. And the higher the velocity of an electron impinged on a viewing screen, the more visible light it will yield.

Introduced, secondly, is an electron optical reduction of approximately nine times. In terms of area, this means that electrons are concentrated on an area 80 times smaller than before. Total luminous flux is therefore radiated in an 80-times smaller image. Total brightness amplification resulting from these two factors amounts to a minimum of 1,000 times.

The image radiated in visible light by the viewing screen is observed by an optical system which enlarges approximately 9 times. This optical magnification, however, does not alter brightness. The X-ray image observed through the optical system is thus seen at a magnitude of one to one.

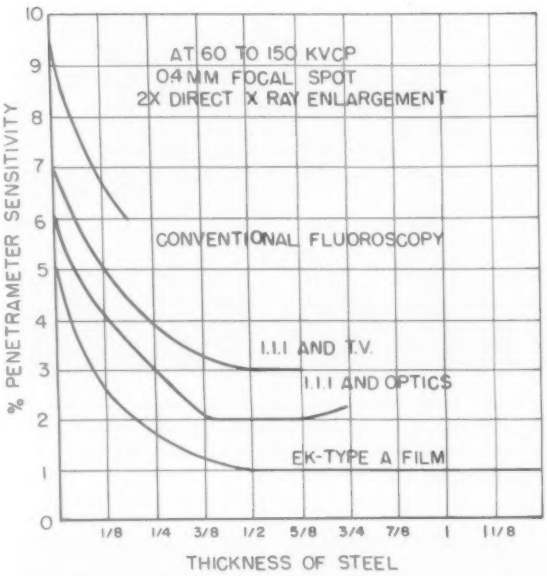
X-Ray Source

When queried on a suitable X-ray source for its electronic fluoroscope, Philips Electronics, Inc., naturally cited the Norelco "MG-150/3", a constant-potential, 150-kv apparatus with a double focus tube. This unit has a 2.5 mm focal spot and can be continuously loaded to 12 Ma.

Such a large focus is useful when the machine is used for film radiography. But the target on the "MG-150/3" can also be switched down to an 0.4 mm fractional focus. Geometric blurring of images is avoided with the shorter focal distance.

This stationary anode tube can be used at a 12-in. film-focal distance, and will show a 1% penetrameter sensitivity through ½ in. of steel. (Sensitivity is a measure of results achieved in radiographing a plate 1, 2, 3% or more of the thickness of the object being viewed. This plate, fixed to the camera side of the object, has three holes of varying diameters. All must show clearly in focus, either on film or in the fluoroscopic viewer.)

In addition to the geometric advantage of a fractional focus tube—and the fact that it can be used at a short distance—there is practical advantage in improved contrast. When X-rays are used at too great a distance, kilovoltage must normally be increased to radiograph an object at economical speed. The kilovoltage increase causes loss of contrast.



RESULTS of Norelco experiments with four steel inspection methods. Industrial image intensification with optical viewing system is nearing sensitivity achieved with fine-grain film. Also being improved steadily is use of "III" with TV.

Electronic fluoroscopy has proved highly useful in examining 30 to 40-ft lengths of welded steel piping. Inspectors using the process report a preference for viewing under moving conditions. Rate of speed most frequently cited as optimum is 10 ft per minute.

In examining X-ray sources for electronic fluoroscopy, Norelco found that half-wave equipment does not give a continuously clear image because of a flicker inherent in this high-voltage production system.

With the use of proper source equipment, it is not difficult to see a 1% sensitivity penetrameter on film when X-raying steel ½ in. thick or more. Since no present code or specification demands penetrameter sensitivity greater than 2%, such equipment obviously meets requirements.

The electronic fluoroscope used with optics (*i. e.*, with a binocular viewer magnifying the fluorescent screen 9 times) will present an image similar in size to the actual defect. Penetrameter sensitivity of 2% is obtainable on steel from ⅜ to ⅝ in. thick. When closed-circuit television is substituted for the optical system, however, some penetrameter sensitivity is lost.

Can It Be Used?

The acceptability of fluoroscopy by those organizations specifying film storage for years is a moot point. At this time, the matter has not been brought under serious study.

Perhaps the groups will always require permanent film records for certain types of radiographed work. Perhaps, however, they will follow the lead of several European countries which rule that, since interpretation of an X-ray image is a human function, electronic fluoroscopy is suitable for virtually any job, and no film records are required.

Dyes, particles work inspection "magic"

By F. W. Foerste

THERE is little argument in welding circles over the fact that non-destructive testing is far superior to destructive testing.

Destructive testing does exactly that; it destroys a sample to determine its strength, yet allows units of the same type as the sample to be produced and used with no testing ever having been done. This is both wasteful and inconclusive.

On the other hand, non-destructive inspection methods can test all items and harm none. Non-destructive testing systems fall into two categories: deep, subsurface inspection; surface and shallow subsurface inspection.

Testing Types

Though it is the only practical method of probing for deep defects, X-ray is generally too expensive for other needs. With this in mind, the inspector must call upon other detection methods, including magnetic particles, dye, and fluorescent dye penetrant materials. Low-priced and sure, they give positive testing in a brief time.

One of the leaders in the field of magnetic particle testing is Magnaflux Corp., Chicago, Ill. By constant experimentation, the company has been able to perfect old techniques and develop new ones, making magnetic particle and dye penetrant testing a vital adjunct to the welding industry.

Simplicity is the key word for actual testing with magnetic particles. The piece to be inspected is magnetized and ferrous particles are scattered upon it. These particles group about any defects—whether on the surface or slightly below it—to indicate their size and extent.

MAGNETS, when completely closed, have a continuous force field. Once broken, however, new poles appear in the field.

In theory, however, the process is much more complex. Magnetic particle testing operates under the basic North-South magnetic field principle long known to man. Long known—but never completely explained.

The ends of a common bar magnet are designated as *North* poles and *South* poles, so called because they are attracted to the earth's poles. From each end flows a force field. It is this force which attracts ferrous materials to the magnet. Since the field moves toward the opposite pole, there is, in effect, a closed circuit of attraction. To more easily visualize this, a simple experiment can be performed.

Magnetic Fields

Lay a sheet of paper over a magnet and sprinkle it with ferrous particles. The particles will form into lines that indicate the direction of the magnetic force present. They will arc from north to south and south to north, never back upon their original pole.

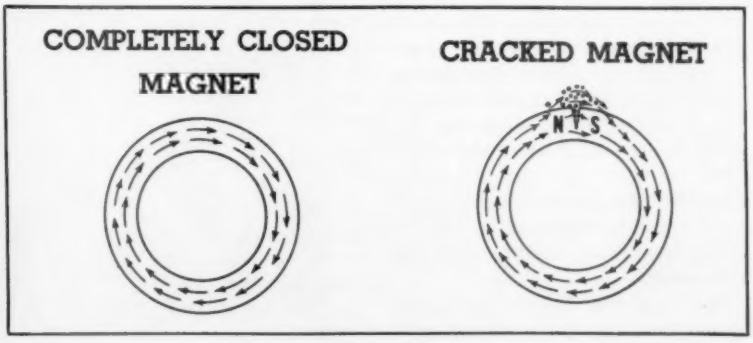
A further experiment may now be made. By splitting the magnet and again sprinkling particles over paper covering the two halves, it can be seen that each half has a North and a South pole. There are now actually two magnets where before there was but one.

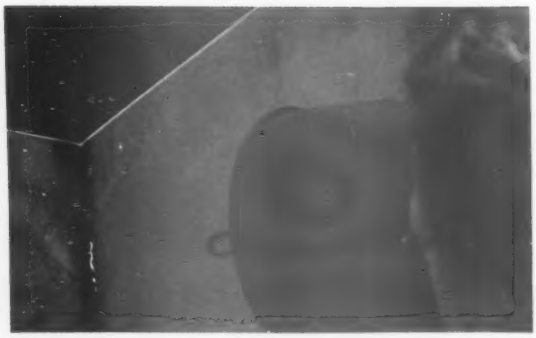
Any fissure, crack, or depression, then, will form polarity in a unit which is magnetized. A weld being tested will, figuratively speaking, have as many "magnets" as it has defects.

Although all matter is subject to magnetism, only iron, steel, cobalt, nickel, and some of their alloys are affected strongly enough to make magnetic particle testing possible.

Magnetic Testing

Usually a unit to be inspected is not magnetized. It is therefore necessary to convert it to a magnet. The





WELD being inspected with fluorescent dye. Dye is brushed on weld, then allowed to penetrate deeply into any defects. All excess dye is washed off before developer is applied. Weld is then inspected in a darkened room with black light. Defects are revealed by dye.

best approach to this is, of course, electromagnetism. Nevertheless, the magnetic force flow must be borne in mind.

For example, magnetic force running parallel to a flaw will create a North-South polarity at the beginning and end of the fissure: the majority of filings will collect at these points *but* only a few will collect along the length of the defect.

In order to test thoroughly, the force must be alternated in at least two directions, transversely and longitudinally.

Once the unit to be inspected has been magnetized, iron filings are powdered upon it or washed upon it in solution. The filings are pulled to the poles of the flaw, and a pattern is formed. As soon as the defect has been recognized, a production engineer can correct it easily.

Magnaflux also manufactures portable probes to electromagnetize the unit. These greatly ease drag on power supply and equipment.

Non-Magnetic Testing

The barrier of non-destructive testing on materials which cannot be magnetized, such as aluminum, magnesium, ceramics, plastics, etc., is crossed by using dyes and fluorescent dyes.

Limitation of this method, although swift and effective, is that only surface defects are located. Subsurface flaws—easily picked up by the magnetic particle method—go undetected. However, it is of inestimable value on pieces which are scaly, rough, and difficult to read with the unaided eye.

The dye penetrant technique is very much similar to that used in plastering. After the plasterer has covered a crack with his material, he wipes it away, leaving the fissure filled in with sealant.

Dye or fluorescent dye is usually dusted upon the piece or washed upon it in an oil solution for good adhesive qualities. After the solution has had time to penetrate—by capillary action—any seams or flaws, it is washed off and allowed to dry. A powder, or water-suspended, developer is brushed or poured on the unit to draw the dye up to the surface of the crack.

The piece is then inspected in a darkened chamber beneath a black light (almost ultraviolet) under which the dye stands out in startling clarity against the black background of the unit.

Characteristics of Penetrants

There are many penetrants. This is true because varied weldments and metals require different treatments during inspection. However, all penetrants must have certain characteristics in order to perform properly. A penetrant must seek out minute defects, and excess dye must drain quickly to prevent leakage from defects.

Yet it must have body enough to feed into cracks while it is on the surface and before the developer is applied. The penetrant must dissolve into defects contaminated by foreign matter. It must be stable so that it does not form scum, separate, nor lose its volative properties in drums or open tanks.

When dried in a recirculating hot air drier, it must not dry out completely, nor bleed out completely; heat aids in bringing penetrants to the surface for sharply defined defect indications. A good penetrant must be easily seen. Although highly fluorescent penetrants cost more than lower fluorescent materials, they are usually more efficient since flaws are more quickly recognized in the weld.

Testing at Work

One steel company had the problem of inspecting tube rounds. Generally, it was a time-consuming, expensive process. By using a magnetic particle test, the firm was able to slash its inspection crew to two men—one to inspect and the other to route our defects with a torch.

Other gains were that the yield of tubing rose 5% as the proportion of defective tubes was greatly lowered. Also an acid pickling step (removing scales so the unit can be visually inspected) was eliminated because magnetic particles cling to defects whether they are covered with scales or not. Scrapping the pickling operation has saved almost $1 per ton on steel for the company—a prodigious saving for a large firm.

Although Magnaflux stands alone in the production of fluorescent penetrants, Met-L-Chek Co., Los Angeles, Calif., and Turco Products, Inc., of the same city, also manufacture dye penetrants.

In the magnetic particle testing field, besides Magnaflux Corp., are North American Phillips Co., Inc., Lewiston, Me., and Sonoflux Corp., Houston, Texas.

With constant quality improvement and increasing production of magnetic particle, dye, and fluorescent dye penetrant materials, these nondestructive test methods may one day vie with radiography in popularity.

MAGNETIC particle test as applied to a weld. This accurate and fast method permits detection of surface and shallow subsurface flaws. Because ferrous particles align along poles of a magnet, inspector is able to locate any errors occurring during the welding process.

A look at—
and through—X-ray Films

Deep problems? radiographic films are silent servants

GAMMA radiography set-up. Anode sends rays through specimens.

ALTHOUGH radiography of the human body has been common since 1900, it was not until 1939 that demand prompted some firms to produce X-ray film for industrial use.

And yet today, even though the fact remains comparatively unknown to laymen, the largest market for radiographic film is in the industrial market.

The principle of the X-ray photograph is simple. It operates in a manner somewhat similar to the way in which a shadow is cast. Sunlight is unable to penetrate the body; therefore, a lightless patch, which we call a shadow, is only an area of space not receiving sunrays.

An X-ray is very similar to visible light—its wavelength, however, is so short that only the most refined experiments reveal it. Metals being radiographed behave much as the body does: they do not allow some X-radiation to pass. A flaw in metal or in a weld presents less density and rays are able to pass through and record its presence.

Black upon White

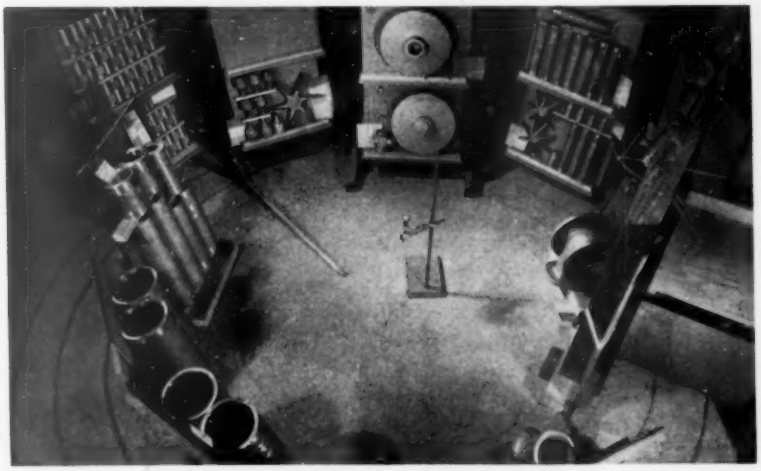
It must be borne in mind that the usual X-ray photographs we view are *negatives*. That is, our usual visual patterns are reversed. What the eye views as black is reversed to white and white is changed to black. Hence a normal black shadow is seen as white.

Radiographic film generally consists of a blue-tinted cellulose acetate base upon which an emulsion of gelatin containing a silver compound is coated to a thickness of 0.0001-in.

Extremely sensitive, the emulsion changes its physical structure when X- or gamma-rays strike it. When treated with a developer (chemical solution) minute granules of black, metallic silver appear, forming the image.

Unlike the usual method of photography, X-ray film is placed *behind* or *beneath* the object to be radiographed. The X-rays are beamed from the anode, pass through the specimen, cause the film to react, and are halted by a lead sheet placed behind or beneath the film.

EXAMINATION of cylinder with X-ray equipment. Rays completely penetrate specimen, leaving shadow picture on photographic plate for examination.



Radiography Methods

Since X- or gamma rays, again like light, tend to refract (the summer glare from asphalt pavement is an illustration of this refraction), lead sheets with a diaphragm are suspended between camera and specimen. These prevent dangerous radiation scatter.

X-ray diffraction is quite unlike radiography, but it also makes use of film. In this process, there is no shadow cast. Usually employed in testing molecular structure, the X-ray strikes the surface of a crystal, is deflected to the film, and the pattern of the molecules is revealed. This is an effective inspection method for effects on metal caused by cold working and annealing.

Spectral analysis is another form of exographs. By this method it is possible to examine strata in metals and to determine the blending of alloys used. X-ray beam and specimen are arranged in such a manner that dark bands—strata—appear on the film. The position of strata indicates alloy blending and any strain conditions.

(Manufacturers of industrial fluoroscopy equipment with image intensification have a different view on the need for X-ray film. Be sure to read, "Fluoroscopy . . . will it reduce the need for film?" *in this issue.)*

Refinery finds

Portable X-ray unit is an indispensable maintenance tool

By F. T. Tancula

USE OF X-RAY equipment for non-destructive weld testing is not limited to production-line work. A large oil refinery on the Eastern seaboard has found its small, portable X-ray unit an effective maintenance tool.

The refinery's inspection department uses it, not only on tanks and lines that are "down," but also on a vast network of pipe lines which are radiographed through the product.

This ability to inspect lines "on stream" results in faster repair and less down time, and enables management to order materials and manpower where and when needed with minimum loss of time.

Quality Control Needed

X-ray has been employed by the inspection department for about two and a half years. Prior to this, only visual inspection of welds was used. Trepanning plugs was a method employed for a short time just before they turned to X-ray.

Tank trepans showed that four out of every six welds were defective. The high percentage called for a more stringent inspection program than had previously been undertaken.

The refinery's first X-ray unit, which weighed 65 lb, was rented. But after a careful cost analysis by Inspection, management decided it was more economical to own its equipment.

A Baltospot, manufactured by Balteau Electric Corp., Stamford, Conn., was purchased for $2,750 six months ago. The unit weighs but 47 lb, will X-ray up to 1½-in. steel and can be operated by one man. It is rated at 140,000 volts. No other means of weld inspection has since been employed.

Inspection crews take an average of 100 X-rays a month, but amount of radiographic inspection varies with the type of vessels or pipelines being fabricated. Some codes call for 100% inspection.

Seek Top Quality

X-ray has also aided in development of a better weld quality program. Each of the 75 weldors' work will be radiographed about every six months. Photos of six sample welds are taken at random.

A spokesman for Inspection told WELDING ENGINEER that "identical quality is sought in all lines, regardless of type of service—lube oil, fresh water, salt water, or high-pressure steam."

Some of the code specifications that must be met: API 12 C for tank work, API 1104 for general field pipelines, ASME-ASA B 31 for pressure piping, and the ASME code for unfired pressure vessels. The highest code specifications met will be the quality sought in every other instance on similar equipment, this same spokesman said.

A catalog of weldors' films show that each has a peculiarity in his work that is as distinguishing as his own signature. This individual peculiarity has enabled Inspection to spot a man's work almost immediately.

If a defective weld is found in critical service lines, it must be cut out and rewelded . . . and often a larger section than is necessary is removed so Inspection can show it to the weldor and explain what made it a bad weld.

In instances where a bad weld shows up in non-critical lines, the refinery uses an Arcair torch to gouge the defective weld. Use of this type of torch is preferred over mechanical chipping, an inspector said, because the weldor can better see his mistakes.

Soundness Insured

In listing advantages of X-ray over trepanned plugs, the oil company spokesman highlighted the fact that, in radiography, the repaired weld can be re-tested to see that rework has made it a sound weld. When trepanning alone is used, the repair itself may be defective.

In addition, cost of trepanning and rewelding was found to be far greater than radiography. Convenience is another X-ray advantage.

The refinery's new quality control program is paying off in better welds. The X-ray unit is an important training tool for weldors—they can be shown their errors. Use of X-ray has an added psychological effect on the weldors. Its mere mention seems to spur the men to do better work.

Inspection's maxim: "Teach a weldor to make a good weld on a sewer line, and he will make a good weld on a high-pressure line." Since the refinery management feels it is just as easy to make a good weld as it is a bad one, its standards are fairly high on all types of work. A company spokesman said, "We pay top money for the work; we want top welds."

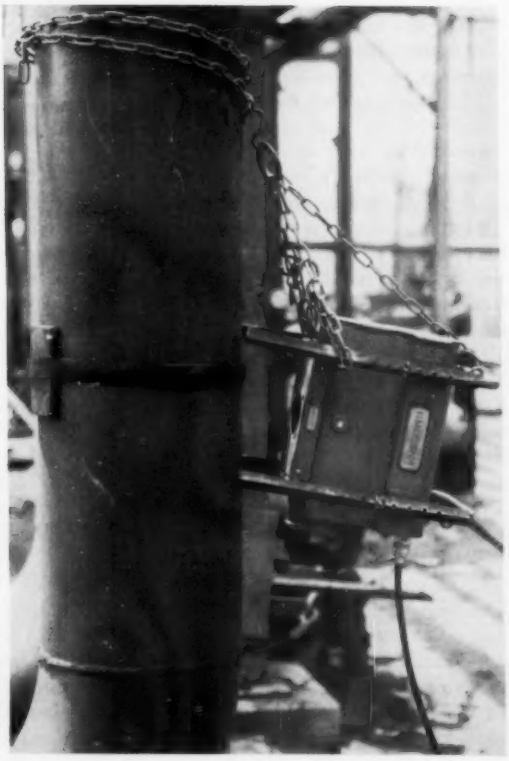
Calcium Tungstate Screens

The eastern refinery uses calcium tungstate high-speed screens in conjunction with Kodak industrial "Type F" film, also high speed. Exposure time is 1½ minutes. On tanks and large diameter pipes, 5 x 17-in. film is used. Smaller lines are radiographed on 5 x 7-in. film. The

FIRST step in inspecting welded seam on oil storage tank is positioning portable X-ray unit. Tube is 18 in. from seam and is held in place by light chain rigging.

SECOND step is positioning of 5 x 7 in. film strip, opposite X-ray tube, on inside of storage vessel. Four magnets hold film in place.

THIRD step in inspection of storage tank seam is connection of X-ray unit to control box. Cable is 25 ft long and all personnel maintain this same distance from tube for safety reasons.



BUTT weld in 12-in. vertical pipe is radiographed by portable unit. Focal distance between camera and film is 18 in., and will produce 9.8 in. of diagnostic film length. Film is tightly secured to weld with 2-in. strip of rubber.

operator must stand at least 15 ft away from the tube, while he operates it from a control panel. A small portable generator is sometimes necessary when power lines are not accessible.

Lead foil screens, which would give clearer pictures, are not used because of the longer exposure time needed. To clear the work area for an extended period would involve a lengthy work stoppage. Besides, the refinery feels that calcium tungstate screens are satisfactory. A clear photo of each penetrameter is obtained, and that is the prime requisite.

The penetrameter is used as a guide for ascertaining that the X-ray is in clear focus and penetrating. The refinery demands 2% sensitivity; *i. e.*, 2% of the thickness of the steel wall being inspected.

The penetrameter is a test piece of the same material being examined. It is taped to the camera side of the joint, while the film is on the far side, away from the camera.

The penetrameter has three graduated holes, diameters of which are two, three and four times the thickness of the test piece itself. Each of these holes must be clearly defined on the film, indicating proper focus and penetration.

Magnets Hold Screen

Inspection uses magnets to hold screens and film on tank work; a simple inner-tube band keeps film on pipelines.

The penetrameter itself is held in place with masking tape and, when necessary, is built up with shims of identical material to match thickness of the weld reinforcement.

Optimum distance at which the refinery's unit is used is 24 in.; *i. e.*, the source of radiation is 24 in. away from the film. Inspection personnel always wear film badges to detect radiation.

This progressive oil company finds X-ray an important inspection tool in areas other than welding. When boiler tubes begin to pit, X-rays will find the spots. Other uses are finding:

(1) Lead lining defects (acid agitators at the refinery are so lined).

(2) Pitting in pipe bends.

Light, portable units have made X-ray economically feasible for many new applications. Training an operator takes little time, and one-man operation has uncovered new fields for manufacturers of portable equipment.

X-RAY technicians prepare a portable radiographic unit for operation. With equipment installed in the "Inspectobile", X-ray photographs can be broadcast over long distances and viewed in broad daylight.

Tonight on channel . . . ?

Mobile display boasts some x-ray extras

A touring "Inspectobile" van is the method General Electric Co. has chosen to put new and improved industrial X-ray products on display throughout the country.

Exhibits of equipment and supplies carried by the truck—as well as demonstrations—are being scheduled in various locales by area sales representatives of G-E's X-ray department.

Long-Distance X-ray

Foremost among new developments is a "TVX" television X-ray system that permits viewing of fluoroscopic images over long distances, and in broad daylight.

Another facet of the Inspectobile display is the exhibit of a new medium known as "Xeroradiography" which allows X-ray photographs to develop an image in less than 60 seconds. The process—utilizing a dry selenium-coated plate—does not require a darkroom for development.

Another advantage of "Xeroradiography" is that the X-ray plate can be "erased" like a blackboard and used again for another exposure. A permanent record can be made of an image by the use of heat-transfer or photographic methods.

The images produced by the process are said to be distinguished for clarity of detail and the many densities which can be included in one exposure.

If desired, the photograph can be projected over "TVX" through any television station's control panel to reach offices, or all television sets in an area. The image itself is reportedly brightened more than 10,000 times by the special TV system in the Inspectobile.

The portable X-ray unit in the van operates at 175,000 volts, and can be transported from the truck into a plant or office when the product cannot be brought to the X-ray machine. The system is powered through a single-phase 220-volt line.

Tear Sheets

While the supply lasts, tear sheets of the articles on non-destructive test methods contained in this issue of WELDING ENGINEER will be available upon request. Please address requests to WELDING ENGINEER, P. O. Box 28, Morton Grove, Ill. There are still some tear sheets available from the June issue of WELDING ENGINEER which featured Tig welding.

Makes reading easier. . . quicker

KODAK Industrial X-ray Film, Type AA

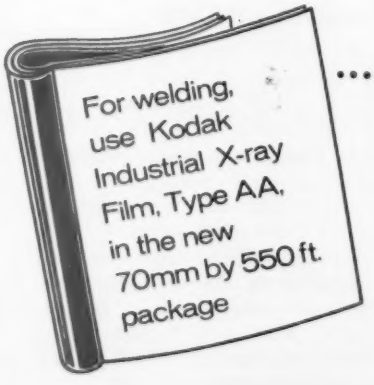
Kodak Industrial X-ray Film, Type AA, gives you greatly increased speed — a film characteristic that brings the radiographer greatly extended possibilities.

As an example: by using reduced kilovoltage and usual exposure time, greater radiographic contrast and easier readability are obtained.

In addition to ranging up to double the speed, this new film retains the fine sensitivity characteristics which made Kodak Type A the most widely used x-ray film in industry.

Kodak Industrial X-ray Film, Type AA, can save you time and extend the usefulness of your present radiographic equipment. Get all the details. Contact your x-ray dealer or Kodak Technical Representative.

EASTMAN KODAK COMPANY, X-ray Division
Rochester 4, N. Y.



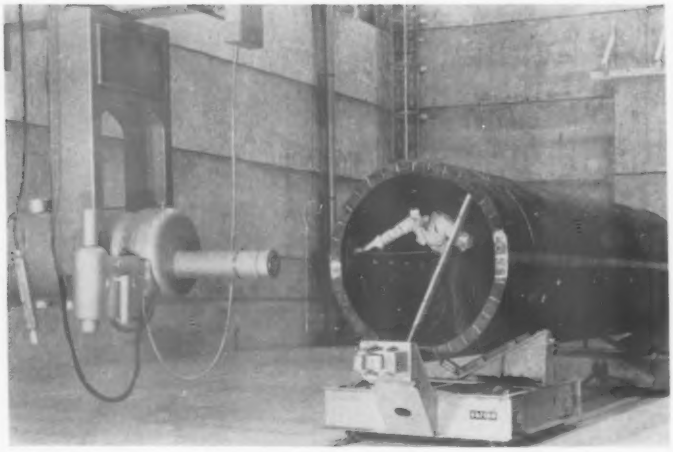
Read what the new Kodak Industrial X-ray Film, Type AA, does for you:

- Reduces exposure time—speeds up routine examinations.
- Provides increased radiographic sensitivity through higher densities with established exposure and processing technics.
- Gives greater subject contrast, more detail and easier readability when established exposure times are used with reduced kilovoltage.
- Shortens processing cycle with existing exposure technics.
- Reduces the possibility of pressure desensitization under the usual shop conditions of use.

Kodak
TRADE MARK

The supervoltage "Van de Graaff" provides . . .

Radiography through particle acceleration



TECHNICIAN makes necessary measurements in welded, heavy-walled tube before radiographing seams with large "Van de Graaff" unit.

DEVELOPMENT of radiographic methods to fit the heavy demands of industrial inspection was initially delayed because early X-ray tubes lacked the ability to take voltages necessary for penetrating thick metal sections.

However, even as X-ray tubes were improved, and as the field of nondestructive industrial inspection grew to its present proportions, the need for very high voltages has never diminished.

Electrostatic Generation

The first machine providing supervoltage X-ray generation was developed in the early 30's by Dr. Robert Van de Graaff, then associated with Massachusetts Institute of Technology. With rated output of 5.4 million volts, the "Van de Graaff" prototype set a long-time record.

As opposed to such sources of radiation as alpha-particle and gamma-ray types, transformer systems, orbital accelerators and nuclear reactors, Van de Graaff's unit produces radioactive particles by electro-static voltage generation.

A "Van de Graaff's" particle beam is accelerated by constant potential, so beam current is d-c. Its preset value is reportedly constant within a few percent. Monoenergetic particles are produced according to their electric charge, regardless of their mass.

Protons, deuterons, tritons and helium ions can be accelerated in a "Van de Graaff" unit, and the machine is also a source of monoenergetic gamma rays. This supervoltage accelerator, when converted to negative operation, will produce electrons, the source of X-rays.

RING weldment 3½ in. thick is set up for 360-deg X-ray in testing lab of Arnold Greene & Co., Cambridge, Mass. One-million-volt "Van de Graaff" generator supplies necessary power for brief two-minute exposure.

Continuing Promise

In 1946, Dr. Van de Graaff, in conjunction with J. G. Trump and D. M. Robinson, helped found High Voltage Engineering Corp. in Burlington, Mass. This firm has now built over 150 "Van de Graaff" particle and linear accelerators for industrial, medical and nuclear research.

Although High Voltage is the only commercial manufacturer of the particle accelerator, several "Van de Graaffs" have been constructed by scientists at research and educational institutions for their own use.

P&H

All standard models give 360° rotation, full 135° tilt, and full elevation even under capacity loads

Your **biggest** saving in welding is in weldment **handling**

P&H Welding Positioners often cut costs up to 43% by making weldment handling easier.

They raise, rotate, and tilt weldments up to 100,000 pounds, completely freeing operators from the time-consuming, hazardous job of repositioning weldments on the floor.

RESULT: Increased production, less operator fatigue, metal flows more readily, pools more evenly to produce cleaner, stronger welds — because all welding is done in the natural *downhand* position.

For more information about how these useful machines can save you money, write to Department 305B, Harnischfeger Corp., Milwaukee 46, Wis.

HARNISCHFEGER

P&H WELDERS • ELECTRODES • POSITIONERS
MILWAUKEE 46, WISCONSIN

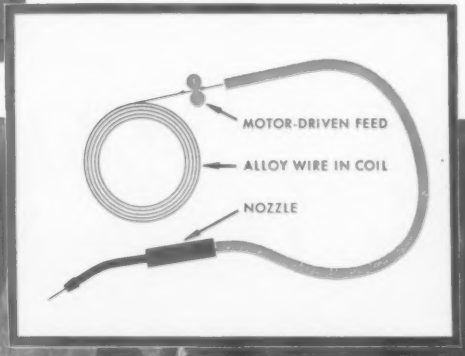
Semi-Automatic

with STOODY WIRES

Takes the work out of welding — speeds application — cuts overall costs!

How Stoody Semi-Automatic Hard-Facing Works

Stoody Wires are supplied in layer-wound coils for use on any automatic welding machine, with minor conversions. The wire is mechanically fed to the nozzle by a motor-driven feed roll and idler roll which are actuated when the arc is struck. The welder thereafter merely directs location of the weld deposit, the machine feeding the wire automatically as the arc is struck, stopping when the arc is broken.



Hard-Facing

Semi-automatic hard-facing with Stoody Tubular Alloy Wires is one of the greatest labor-saving processes yet developed for the maintenance man! It hustles you through jobs at speeds 2 to 4 times faster than manual welding. Wires are bare, need no flux or flux dams. Deposits are thus fully visible during welding... easy to lay along an edge or to a mark.

With Stoody Wires you get *low penetration*, this means less dilution and, consequently, a higher alloy content in the final deposit. Wear resistance is thus improved... usually superior to manual electrodes of similar analysis.

Finish on the wire is clean and bright, free from burrs and slivers, insuring smooth feed through the machine. Because the wires are drawn through special sizing dies after being formed they are concentric, true to diameter and uniform throughout their length. Special chemically coated papers protect against rusting and the fibreboard shipping container insures all shipments arriving undamaged, ready for use.

When you load your first coil of Stoody Wire you'll find the nylon wrapping especially handy—no heavy wires or straps to remove, yet the wire stays coiled till you're ready to weld!

Remember, with Stoody you get a complete range of proven, time-tested wires, from low alloy to high alloy types, plus a tungsten carbide... all backed by 10 years use in the field!

Nickel Manganese and Stoody 121 Wires are available in 3/32" or 7/64" O.D. Other alloys in 7/64" diameter only. All Stoody Wires feed through most semi-automatic machines with only minor changes in wire guides, feed rolls and nozzle.

For more information see your nearest Stoody dealer, 600 of them, in all parts of the U.S. and Canada (check the Yellow Pages of your phone book) or write direct.

STOODY COMPANY

11937 East Slauson Avenue
Whittier, California

Stoody 100

Applications... Crusher rolls, impellers in impact type crushers, bucket teeth and lips, scarifiers and rippers, tool joints, cement mill pulverizer rings and loader lips

Stoody 100HC

Applications... Catalyst piping, Banbury mixers, crushers and parts subject to severe abrasion

Stoody 102 *(for submerged arc application only)*

Applications... Cable sheaves, small diameter shafting, shovel idlers and equipment subject to high compressive loads

Stoody 104

Applications... Designed primarily for build-up of carbon and low alloy steels

Stoody 107 *(for submerged arc application only)*

Applications... Crane wheels, house rollers, mine car wheels, tractor and shovel parts subjected to severe impact

Stoody 108

Applications... Sprockets, shovel idlers and pads

Stoody 121

Applications... Crusher rolls, impellers in impact type crushers, bucket teeth and lips, scarifiers and rippers, cement mill pulverizer rings, loader lips

Stoody 130

Applications... Earth boring and scraping operations on equipment such as tool joints, augers, conveyor flights, scraper blades, rippers and concrete mixer paddles

Stoody Nickel Manganese

Applications... Strength welding and rebuilding of manganese parts

Portability plus light weight make this self-propelled X-ray unit . . .

An ace-in-the-hole for pipeline inspection

ELECTRICALLY-driven tractor *(A)* propels gas-insulated X-ray unit *(B)* through pipes 14 in. in diameter or larger. Unit stops automatically at each weld seam and inspects circumferential weld in one exposure.

PIPELINE WELDING in the field is not an easy job—even under the most ideal conditions. When temperatures suddenly drop, or a weld is rushed to completion in the rain, sound welds are not always obtained.

Immediate detection of faulty welds by X-ray inspection on the job saves time and needless expense. It may also save lives and prevent property loss.

Better Dielectric

Pioneers in development and use of portable equipment for this type of field inspection service is Industrial X-ray, Inc. of Seattle, Wash. The firm's unit, which weighs only 86 lb and is self-propelled, will photograph a complete circumferential weld with a single exposure.

The portable X-ray machine can operate in all pipes 14 in. in diameter and over. It uses sulphur hexafluoride rather than oil as a dielectric, achieving both improved performance and weight savings.

Special X-ray tubes used in the unit to permit 360-deg radiation are manufactured by Dunlee Corp. of Chicago. To keep the tubes as small as possible and light in weight, Dunlee uses a high-density "77 metal" shield close to the source. This special metal was developed by Fansteel Metallurgical Corp., North Chicago, Ill.

Typical tube design for the special X-ray unit includes a stationery tungsten target and a beryllium window imbedded in the metal shield. It is the shield which confines radiation to a desired pattern, and the beryllium window which provides a 360-deg beam and a point for mounting the metal shield to the anode.

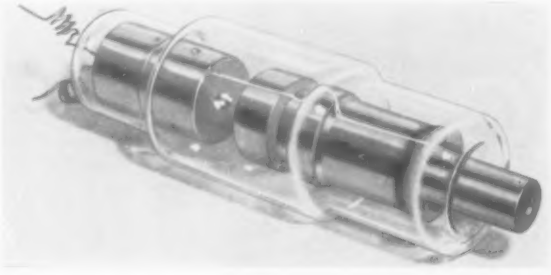
An equally important function of the beryllium window in these high-voltage tubes is to protect the glass envelope from dielectric breakdown by preventing excessive electron radiation.

Cuts Down Weight

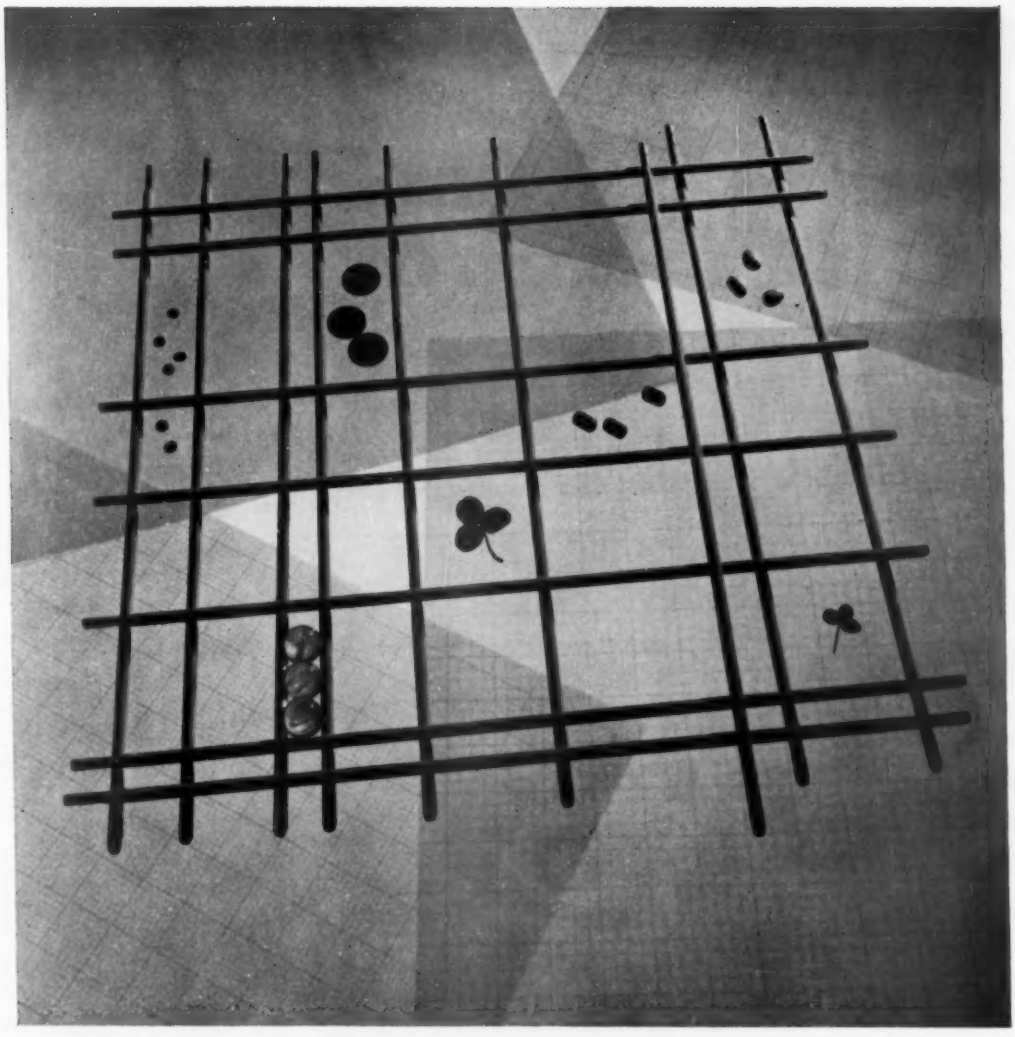
Fansteel's "77 metal" is 50% heavier than lead, but the amount of lead necessary to line the tank and do an equally effective job of protection would weigh twice as much as the "77 Metal" now being used. Use of the special material, then, cuts costs and aids portability.

In operation, the X-ray unit (with the tractor which propels it) stops automatically at each weld. It will expose a single strip of film taped, for example, to a 36-in.-diameter circumferential weld in less than 2 minutes.

Obviously faster and less costly than destructive pipe testing methods, the portable X-ray unit is also said by its manufacturer to be approximately 7 times faster than external radiographic methods.



SPECIAL shield of "77 Metal" *(left)* aids small X-ray tube in making 360-deg exposures. Shield material is 50% heavier than lead, but twice as much lead would have to be used to do comparable work.



In welding rod coatings... UNIFORMITY *starts with the ingredients!*

UNIFORMITY isn't something you grind, coin, grow, or stir into welding rod coatings . . . it's got to be in the INGREDIENTS! That's why leading manufacturers of welding rod coatings specify raw materials of the highest chemical and particle size uniformity... the kind of raw materials Foote has been making for over 30 years!

The chemical composition of Foote raw materials is carefully controlled by rigid chemical analysis standards, and by special process equipment and procedures.

The optimum particle size requirements for the more than 30 different materials used in welding rod coatings have been developed through many years of close cooperation between Foote and manufacturers of coatings.

You'll want to know more about these fine products and how they can help you produce better coatings. So write for our informative brochure, entitled "Raw Materials For Welding Rod Coatings". Address request to Technical Literature Department, Foote Mineral Company, 453 Eighteen West Chelten Building, Philadelphia 44, Pa.

Foote
MINERAL COMPANY

Pioneer in the manufacture of welding rod coating materials

RESEARCH LABORATORIES: Berwyn, Pennsylvania

PLANTS: Cold River, N.H.; Exton, Pa.; Kings Mountain, N.C.; Knoxville, Tenn.; Sunbright, Va.

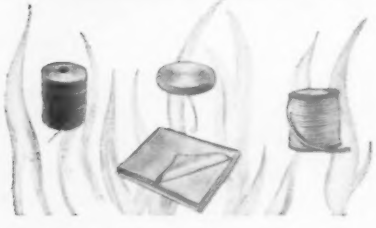
WELDING GRADE FERRO ALLOYS • LITHIUM METAL, CHEMICALS, MINERALS • STRONTIUM CHEMICALS • ELECTROLYTIC MANGANESE METAL • STEEL ADDITIVES • COMMERCIAL MINERALS AND ORES • ZIRCONIUM, TITANIUM, HAFNIUM IODIDE PROCESS

...made of J-M Asbestos Cloth by prominent Chicago manufacturer

• Here's an excellent unit for on-the-spot handling of fires—the Fite Rite Blanket in the flip-open case for split-second protection of equipment and personnel. Made of Johns-Manville Asbestos Cloth—in commercial and Underwriters' grades to AAA—the Fite Rite Blanket is produced by Cotton Goods Mfg. Co., 216 N. Clinton St., Chicago, Ill. Standard blankets and curtains made of J-M Asbestos Cloth are also included in the Fite Rite Line.

Fabricators of top-quality clothing, curtains, and other protective materials offer J-M Asbestos Cloth in the forms that are most practical in your operation. For the name of your local distributors and fabricators of products made of J-M Asbestos—or for free booklet TX-2A—write Johns-Manville, Box 14, New York 16. In Canada, Port Credit, Ont.

Johns-Manville Asbestos Textiles

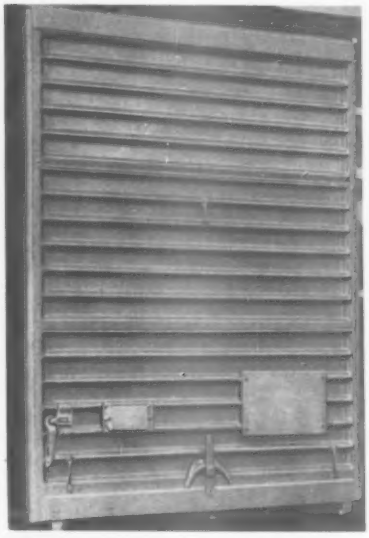


Welded aluminum replaces rivets

RAILROADS are selecting welded aluminum box car doors over standard riveted construction because of greater speed in assembly, lower cost, lighter weight and because a less sectional product can be obtained.

Aluminum alloy used is 5086, developed by Kaiser Aluminum & Chemical Co. This alloy, containing magnesium and manganese, is considered unusually strong and highly weldable. Work hardened after rolling, 5086 offers a welding joint efficiency approaching 85%, and is stronger after welding than other common alloys.

Weight, a deciding factor in door construction, is: aluminum, 256 lb; steel, 523 lb.

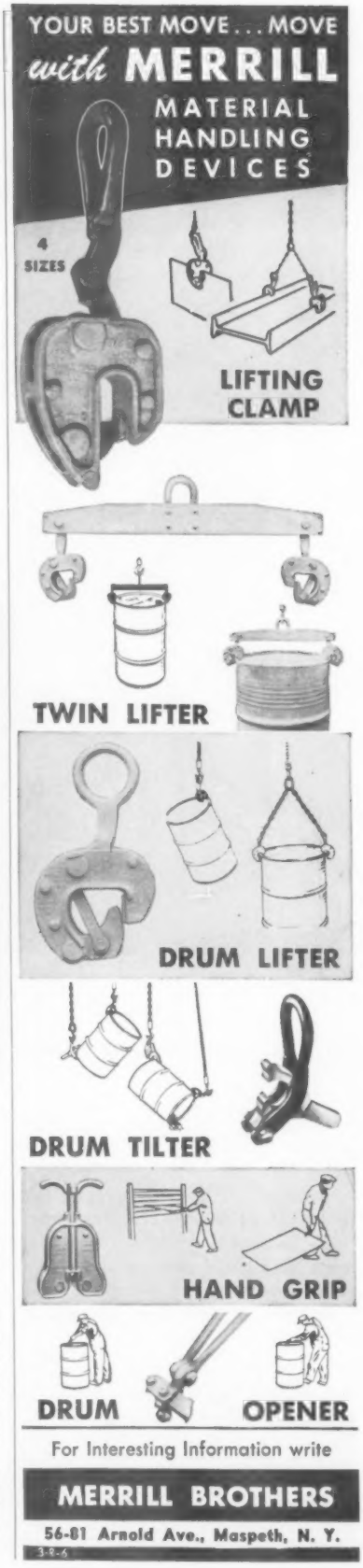


NEW rail car door, expected to change railroad fabrication methods.

Aluminum is extruded to form vertical edges, or "stilers", of the door. The upper edge shown in the picture is ⅛-in. shaped aluminum sheet. The bottom edge consists of 5/32-in. sheet. Door faces are corrugated panels constructed with three 0.109 in. die-formed aluminum sheets.

Doors are assembled in simple jig equipment. The only concession to once-popular practice is the use of hot-driven rivets in the installation of malleable iron door fixtures.

Tests now being held are expected to indicate decided operational advantages of welded aluminum doors over the usual steel doors.



IT'S THE *MOST

ANNOUNCING

the Sensational ***NEW***

miller
GOLD STAR
SR

It ***DELIVERS*** maximum arc stability for:

a. Sounder, denser welds – and more of them – in less time, with . . .

b. ALL electrodes, in . . .

c. Any and all positions

How is this performance possible? THE MILLER GOLD STAR SR introduces a...

NEW transformer

plus

NEW weld stabilized current

plus

NEW completely sealed semi-metallic rectifier

Tested across the country by practical, critical, hard-bitten working weldors, here's what they say about the new Miller GOLD STAR SR:

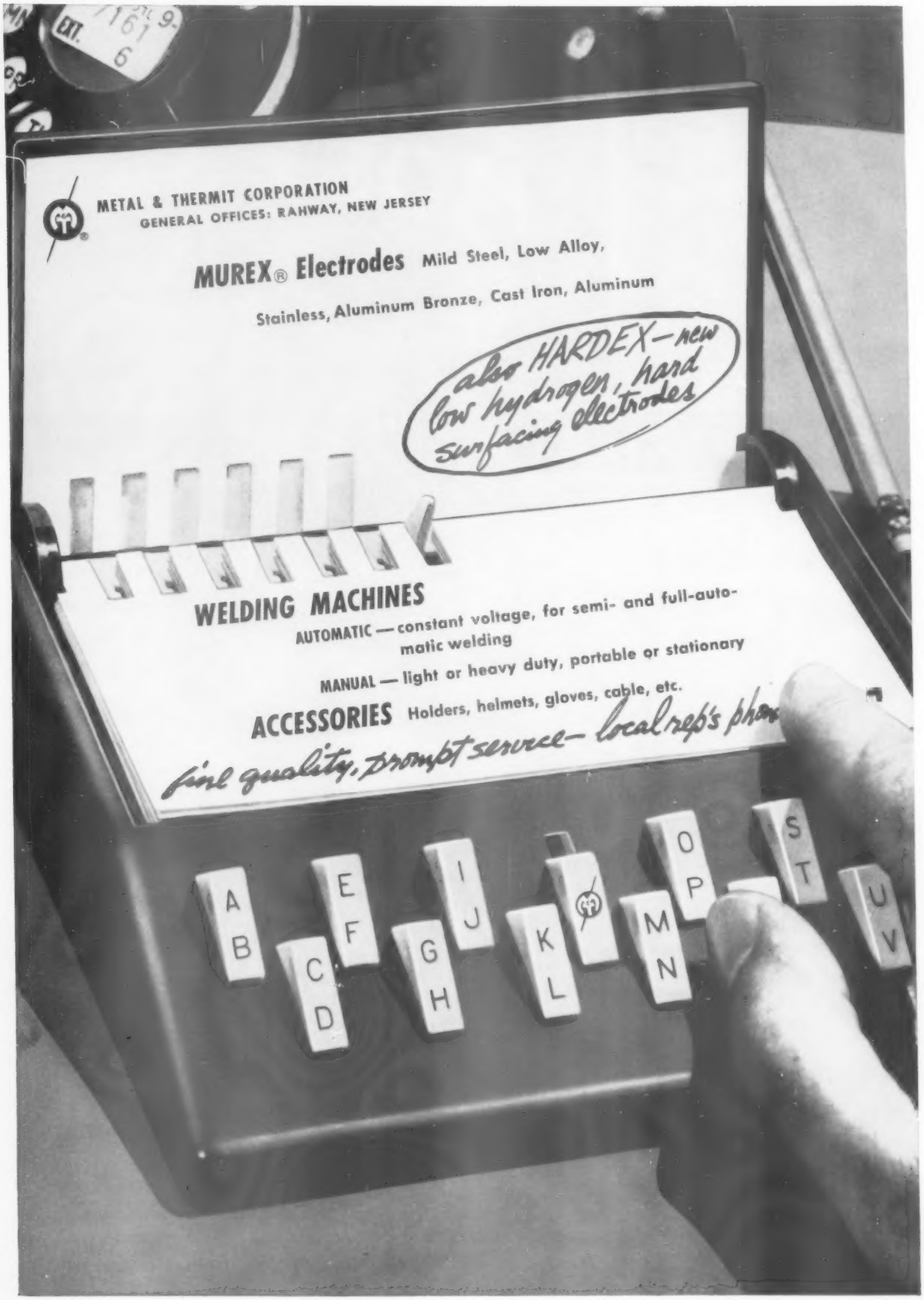
"it's the DC performance I've always wanted"
"here's DC welding current that's . . . perfect!"
"positively handles ALL electrodes better"
"best deal I've seen for v and o work"
"easiest arc starting in my experience"
"smoothest arc I ever used . . . and . . . quiet!"
* "it's just plain the MOST"

Complete particulars on the MILLER GOLD STAR SR, including inert gas and automatic fixture welding, is now available on request.

". . . If it's Miller you know it's the finest . . ."

miller ELECTRIC MANUFACTURING CO., INC. APPLETON, WISCONSIN

distributed in Canada by CANADIAN LIQUID AIR CO., LTD. Montreal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MUREX® Electrodes Mild Steel, Low Alloy,
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AUTOMATIC — constant voltage, for semi- and full-automatic welding
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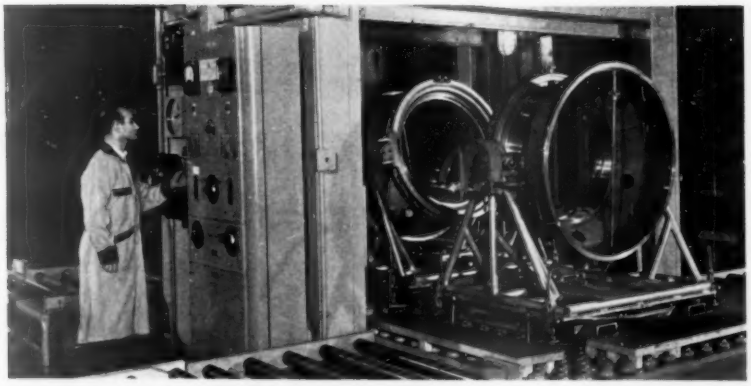


LEFT: Doors of cabinet raise automatically after X-ray exposure. The doors are lead centered to protect workers from harmful radiation.

BELOW: One unit enters the X-ray inspection cabinet while another is being readied. Procedure is faster than old testing method.

"Boxed" inspection speeds jet engine tests

By Fred E. Ebel
X-ray Dept.
General Electric Co.

THE TRADITIONAL lead-lined room for radiographs may be a thing of the past in the aircraft industry. The "OX-250," developed by General Electric Co. for Ford Aircraft Engine Div. in Chicago, permits radiographic weld-testing within a *cabinet* rather than within a *room*.

Ford uses stainless steel welds in the production of diffuser cases (these spread air from the compressor section into the combustion section). Although welds strengthen and lighten the case, the very nature of stainless steel requires complete X-ray testing to insure quality standards.

Geared for high production, the cabinet reportedly increases diffuser case inspection speed over four times the rate obtained while testing in lead-lined rooms.

Motorized Platform

Principle reason for this speed-up is the motorized platform which allows efficient shuttling of the diffuser cases; while one is being radiographed, another is being readied. With this method, there is no wait while workmen prepare the piece.

Driven by a two-speed motor, the platform receives a case from the belt, moves it into the cabinet for radiography and, after film is exposed, rolls it out. A door with a lead center effectively prevents radiation from reaching operators.

The platform travels at 72.5 ft per minute until it is within 12 in. of the track end, where it slows to 24.2 fpm. Its top is fabricated from 3/16-in. welded plate, moved by No. 201A ball bearings.

Structural steel members framing the cabinet are of ¼-in. steel, faced with laminated panels to a 1 in. thickness. The interior is lead-lined: the exterior is plated with steel of stretcher quality.

To insure complete radiation protection, all panel joints are lead-filled steel channel pilasters. These are surface mounted over exterior joints.

Control of X-ray Head

The X-ray head inside the cabinet consists of high-voltage and filament transformers with a Coolidge X-ray tube in a welded steel tank filled with oil. Although the head is capable of operating from 60 to 250 kv at 10 ma, Ford uses it at 180 kv at 8 ma.

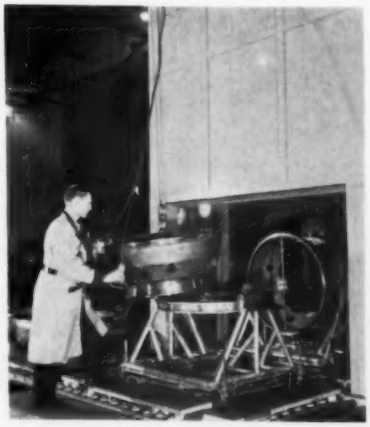
A vertical control panel contains line and X-ray magnetic switches with pushbutton stations and pilot lights. A 52 step auto-transformer is also included.

Other controls in the panel are: a 23-step rheostat, a one second to 20 minute synchronous electrical exposure timer, an integrating hour clock, an exposure counter, and a milliammeter.

The two doors, rising vertically, are steel faced and lead cored. A ⅓-hp motor operates at two speeds—a high speed until doors come within 7 in. of track end, and a low of 24 rpm at this point.

The uncomplicated cycle of the "OX-250" begins when a diffuser approaches the doors. It enters, and the operator closes the doors electrically. A limit switch then begins a 45-second X-ray exposure. When the radiograph has been made, the doors open, one diffuser is deposited on the belt and another enters. The cycle can be halted at any time.

The cabinet permits orientation of the work through 360 deg, vertical or horizontal.



DIFFUSER case is in the process of being X-ray inspected within the cabinet. The new technique eliminates need for lead-walled room.

PAGE-the welding wire

① WIDE RANGE OF ANALYSES •

• When you standardize on PAGE welding wire for your needs—whether for automatic or manual operation, arc or gas welding—you gain all three of these advantages: *first*, you can secure the exact wire you need from PAGE's wide analysis range; *second*, we employ many modern methods of packaging for your convenience in handling and use; and *third*, you can count on prompt delivery service from a nearby authorized PAGE Distributor, who is backed by conveniently located PAGE warehouse stocks.

PAGE has unsurpassed facilities, experience and special skills for drawing and furnishing the right wire for your welding applications. We are ideally equipped to manufacture wire to any desired size, temper or surface finish.

We purchase our raw materials to rigid specifications; we select heats of steels for optimum characteristics—then, upon delivery and before processing, we analyze samples for conformity with our specifications. Thus, PAGE is *the one supplier* in a perfect position to control the chemical and physical properties of its product *from billet to rod to wire!*

Solving tough welding problems

We maintain a fully-equipped and competently-staffed Welding Laboratory where constant research in welding-wire development is conducted —and where many solutions have been found to welding problems that hitherto had defied solution. Here are two typical examples:

1 • Good welds on T-1 steel • Making satisfactory submerged arc welds on T-1 steel had long been very difficult—but a special rod developed in the PAGE Welding Laboratory was recently introduced and already has become the established favorite for this application. As welded on mild steel with inert gas, it gives a tensile strength of 80,000 p.s.i. and elongation of 40%. With proper submerged arc flux, it gives as high as 115,000 p.s.i. and 18% elongation, thus closely matching the physicals of T-1 steel. This is the first automatic welding rod ever produced that makes 100% satisfactory welds on T-1 steel. Its characteristics make it a fine rod also for all-around low-alloy welding.

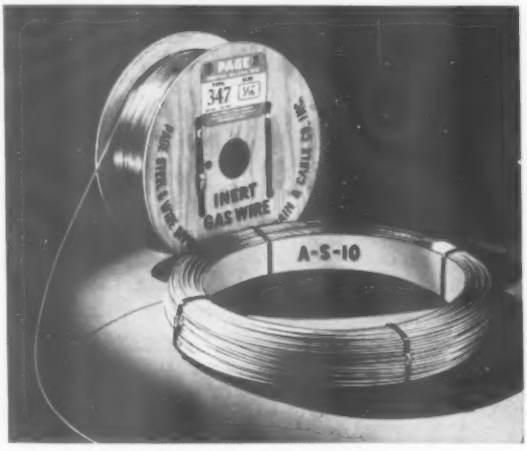
2 • Welding on difficult steels • A manufacturer had been unable to find a welding rod for a weldment that would produce less than 50% rejects. Then he tried a new PAGE alloy rod originally developed for high-temperature (1000° F.) service. Rejects fell practically to zero! Research revealed that this rod, an exclusive PAGE product, possessed properties that make it ideal for difficult low-carbon steels, and particularly in the "hard-to-weld" range from .20 to .45 carbon.

Perhaps you have troublesome weldments on your hands. If so, it will be to your advantage to consult with PAGE.

Write to us at Monessen, Pa., or to the nearest PAGE District Office (opposite page).

Wire to Fill Your Needs— Wide Analysis Range

The PAGE line contains *26 different analyses*, covering the field of applications: heavy automatic submerged arc...light manual submerged arc ...inert gas manual...automatic, tungsten or metal arc.



AUTOMATIC WELDING WIRE

CARBON STEEL...Any carbon from Armco (.025 max.) to high carbon (.70-.84)

LOW ALLOYS...All the most popular welding grades

STAINLESS...All standard AISI grades. Other types on request

GAS WELDING RODS

PAGE Gas Welding Rods have long been recognized as the standard of quality, uniformity and dependable performance. These rods, in an exceptionally wide range, are furnished in coils, on reels or in 36-inch lengths, in the following materials: medium or high carbon steel, mild steel, Armco, low alloy, stainless steel, manganese bronze, naval bronze.

BARE ELECTRODES

PAGE Bare Electrodes are available in any carbon from Armco to high carbon (.70-.84).

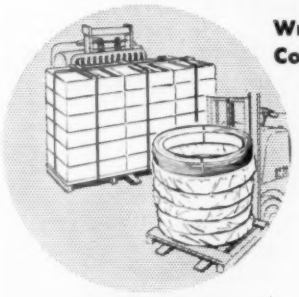
METAL SPRAY WIRE

PAGE Metal Spray Wire is supplied in: any carbon from Armco to .80 carbon, low alloy, stainless steel, manganese bronze, naval bronze.

with 3 big advantages...

②MODERN PACKAGING • ③PROMPT SERVICE

PAGE Packaging Means Protection and Convenience

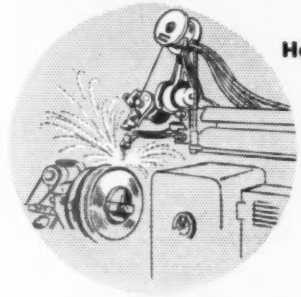


Wrapped Coils... Coils in Cartons

Single and palletized coils, each coil steel-strapped and wrapped in waterproof paper...Also, single and palletized coils in individual cartons.

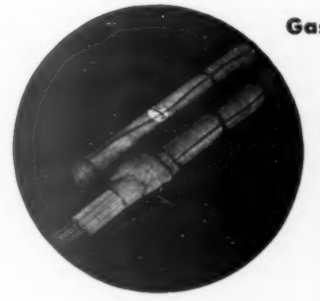
Welding Wire in Coils

PAGE A-S Automatic Welding Wire is regularly furnished in layer-wound coils with cardboard liner, four Signode straps for easy coiling and unwinding—palletized as necessary.



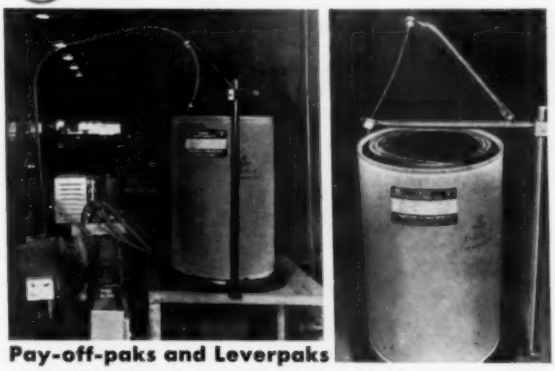
Handy Reels

PAGE Inert Gas Welding Wire is available on 25-lb., nonreturnable palletized reels to fit all popular inert-gas welding machines. Wire is precision thread-wound.



Gas Rod Packing

PAGE Gas Welding Rods are supplied in 36" lengths in 50-lb. bundles, paper and burlap-wrapped. Also in burlap-wrapped coils and 150-lb. (approx.) reels. Stainless rods also available in 10-lb. fibre-board cartons.



Pay-off-paks and Leverpaks

PAGE *Pay-off-paks* permit *continuous feeding of wire up to 600 lbs. (from 20" Pak) or 850 lbs. (from 23" Pak) without rethreading.* Wire is properly coiled, free from welds, kinks or twists. *Pay-off-paks* insure uninterrupted production at increased welding speeds. Can be mounted on floor or bench (*see photos above*). Both *Pay-off-paks* and lightweight *Leverpaks* (*not illustrated*) give protection against distortion and corrosion...are easily opened, resealed, handled, stored. Palletized when requested.

Prompt delivery from local stocks

PAGE automatic arc welding wire and oxy-acetylene welding rods are readily available from PAGE warehouses shown at bottom of this page—and from a nearby PAGE Distributor, wherever you live. Your PAGE Distributor saves you time by filling your needs promptly from his stock. This helps keep your inventory investment down!

Send for These...

Folder DH-402A
PAGE Submerged Arc and Inert Gas Welding Wire

Booklet DH-1277
PAGE Gas Welding Rods

Welding Rod Comparison Chart . . . detailing physical properties as welded of various gas, electric, automatic and spray type welding rods—also typical uses of various rods

Write our Monessen, Pa., office for any or all

ACCO for Better Values

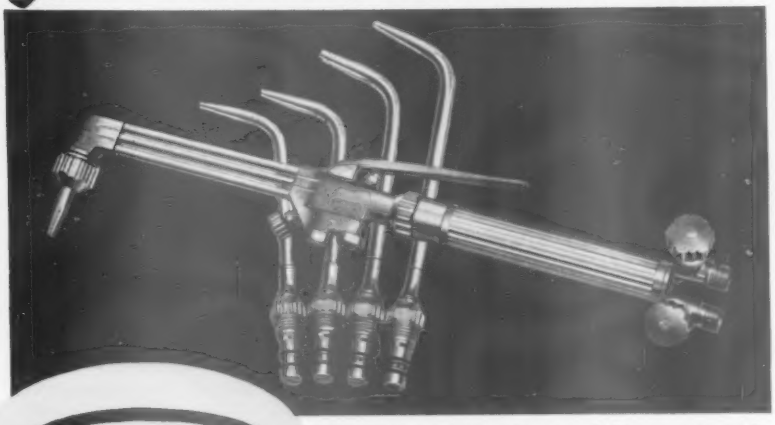
Page Steel and Wire Division
AMERICAN CHAIN & CABLE

Monessen, Pa.*, Atlanta, Chicago*, Denver*, Detroit, Houston* Los Angeles*, New York, Philadelphia*, Portland, Ore. San Francisco*, Bridgeport, Conn.

*Indicates PAGE warehouse stocks

ACCO TRADE MARK

Light, handy Torch does multiple jobs... *cuts, welds, heats, brazes, solders*



SMITH'S **"PIPELINER" Welding Torch and Cutting Assembly**

...with slip-in tips

Developed originally for pipeline welders, this popular little guy has been drafted for all kinds of other uses. You can do welding from 1/32" to 1/4", and brazing and heating jobs. Eight other sizes of Soft-Flame tips increase welding capacity to 7/8". With the cutting assembly you can burn steel from 1/8" to 4" in thickness —clean, high speed cuts with minimum gas consumption. Insert special tips and you can do heavy scarfing, rivet washing and gouging. Tips slip in, tighten with finger twist (no wrench needed). Operators really like that handy 2 lb. weight! Over-all length 16". Your choice 90° or 75° head angle.

SPECIAL TIPS MULTIPLY THE JOBS YOU CAN DO

FOR GENERAL CUTTING. This series gives full range of work from 1/8" to 4". Ideal for pipe cutting and beveling, general production cutting, maintenance and repair jobs of all kinds.

GOUGING TIP. Used for gouging old welds and cracks in steel. Works equally well for deep gouges at minimum width or shallow grooves with considerable width.

"METALEATER" TIP for scarfing and metal washing, rivet washing and removal of stay bolts. Has heavy preheat and will remove a lot of metal fast.

FOR PLATE CUTTING. Two tips in this series will cut sheets and plates from 10 ga. to 1/2". Light preheat. Clean straight-line cuts with minimum gas consumption.

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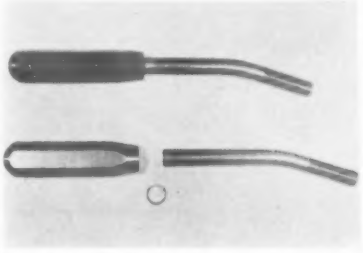
Capillary action rates an assist

Brake levers brazed by alloy rings

THE EFFECT OF HEAT on the capillary flow of molten silver brazing alloy is producing a strong, brazed joint for Automatic Transportation Co., Chicago, a division of Yale & Towne Mfg. Co. The firm finds this method saves time and assembly steps.

Illustrated is a 7-in. steel brake lever used on many of the company's trucks. It is assembled from two parts: a 3/8-in.-diameter steel rod, threaded and bent to the required angle, and a heavy handle fabricated from 3/4-in. hexagonal bar stock.



UNASSEMBLED and assembled brake levers. Ring of low temperature alloy was preplaced, and brazed on heat induction set-up.

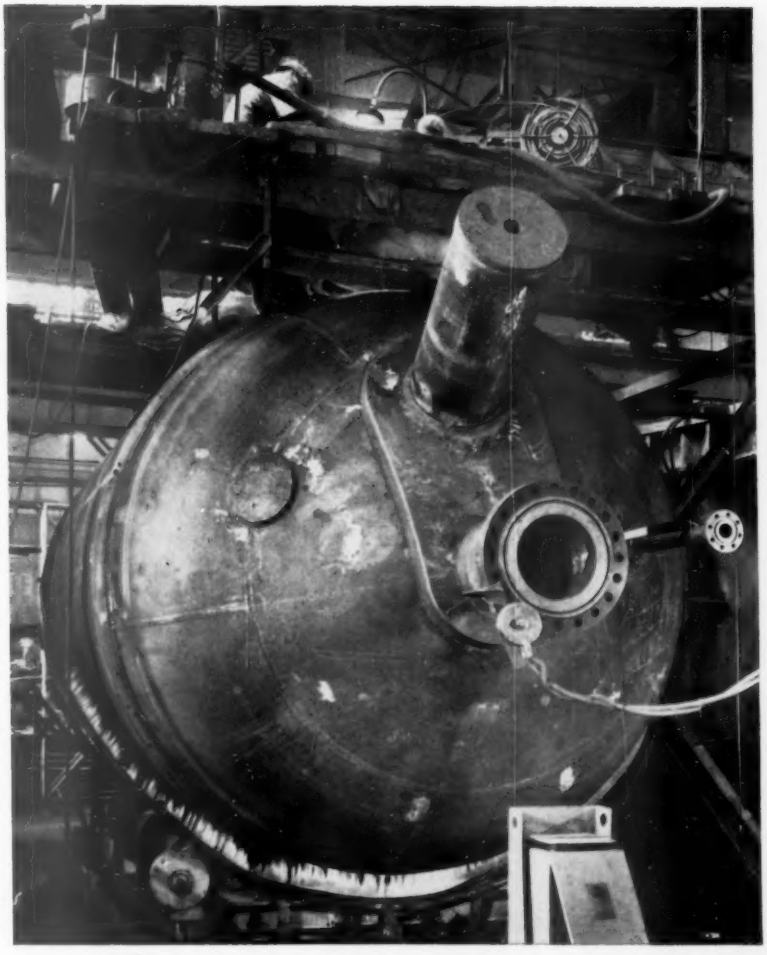
The end of the handle is drilled 3/4 in. deep to provide a rod-seating socket. Radial clearance is maintained at 0.003-0.004 in.

Rod Brazed into Socket

The brake lever is made by brazing the rod into the socket. One ring of 3/32-in. low-temperature silver brazing alloy is used to make the joint. Manufactured by Handy & Harman, the alloy has a flow point of 1,145 F.

The brazing problem is to draw alloy down into the socket from the face of the handle where the alloy ring is preplaced during assembly.

Location of heat source proved to be the solution. Because molten silver alloy moves toward the hottest area



When fabrication codes demand 100% X-ray inspection...

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Stainless Steel Welding Wire

In hundreds of applications, *Drawalloy* wire has been put to the test . . . X-ray, dye check, pressure and service and with the same consistent result—OK as welded. That's why Frank Iapalucci, Manager of Welding Engineering for Baldwin Lima Hamilton, Eddystone, Penna., selected *Drawalloy* chrome-moly wire for the automatic welds on this reactor. The vessel is constructed of A 301-54T Grade B firebox quality steel ranging in thickness from 5-1/16″ to 2-5/8″. *Drawalloy* 1-1/4 Cr, 1/2 Mo wire was used for all submerged arc joints.

When inspection by X-ray is required, don't gamble . . . rewelding is expensive . . . specify Drawalloy "quality controlled" wire. *Drawalloy* stainless steel welding wire is produced to strictly controlled specifications to provide the right chemistry, finish and temper for smooth operation in your equipment and to provide X-ray quality welds.

Why not discuss your stainless welding wire needs with your *Drawalloy* Distributor or Representative . . . a man ready to help you. Bulletin 355-DC provides complete information on every grade of *Drawalloy* wire. Write to: Drawalloy Corporation, Lincoln Highway West at Alloy Street, York 12, Pennsylvania.

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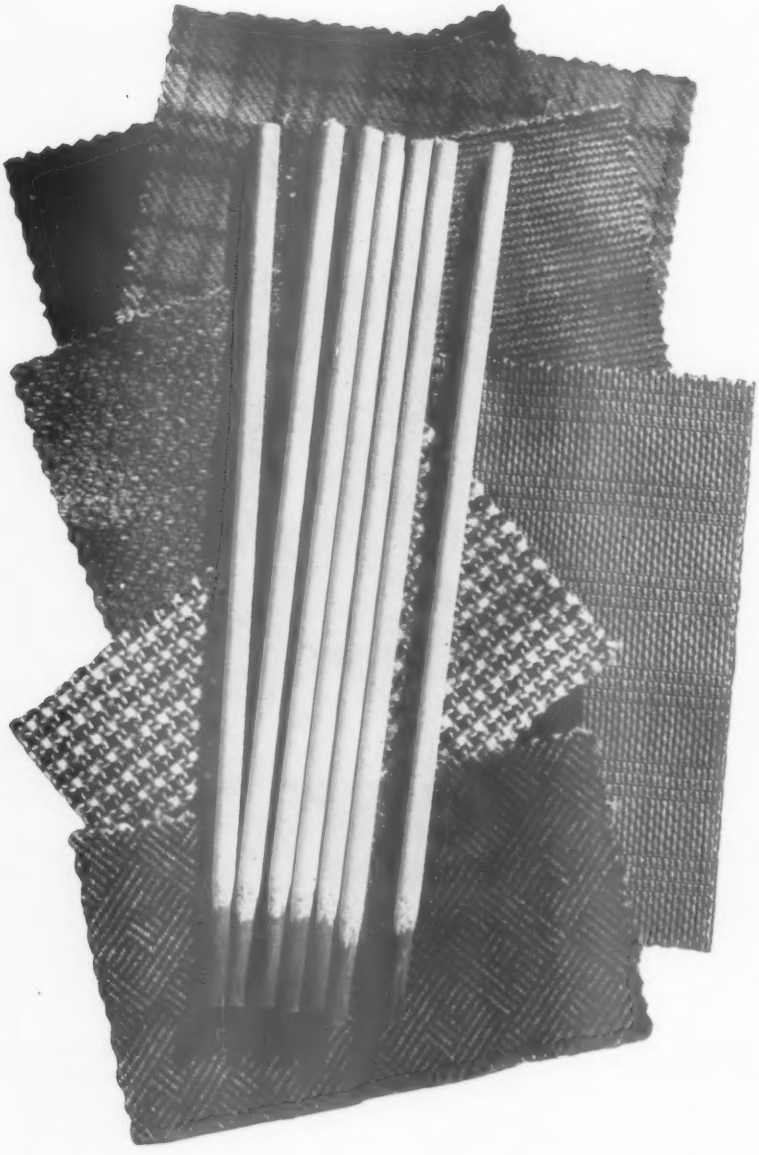
YORK, PENNSYLVANIA

THE WIRE MILL FOR THE WELDING INDUSTRY — STAINLESS STEEL · HARD SURFACING · TOOL STEEL



Rod performance is **IN THE COATING**

COATING FORMULATIONS are the key to electrode performance. When RUFLUX* is used in the coating, it provides several important advantages. The particular advantages depend upon which RUFLUX* products are used.

Manufacturers look to TAM for three types. They are the highest quality Rutiles, Titanates and Zirconium compounds. A TAM sales engineer can give you the facts on any one quickly and accurately while a request to our NYC office will bring you detailed literature.

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*Reg. T.M.

of the metal, a heat source can be used to channel alloy flow to the joint. (Capillary action increases as temperature is raised.)

The brazing set-up, also pictured here, consists of a 3-turn induction coil with a drilled-out block below the coils into which the hexagonal handle is seated. When the assembly is properly seated, the upper coil is slightly below ring level. This concentrates heat along the length of the socket so that alloy is drawn from the relatively cool upper surface down into the interior of the socket.

Assembly Steps Saved

Were it not for this capillary flow, additional alloy would have to be preplaced inside the socket, involving extra assembly steps as well as additional positioning.

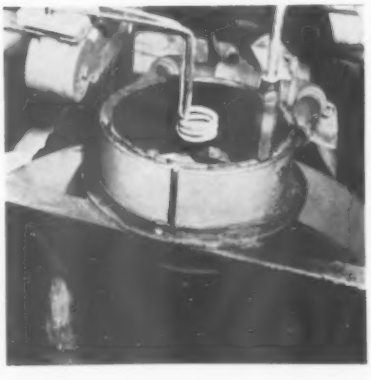
Unless precautions are taken to allow entrapped air to escape during the heating cycle, brazing a rod into a blind hole can be a difficult operation—internal pressure can shift assembly alignment or resist entry of the alloy.

This is partly overcome by leaving a fairly large clearance between rod and socket to permit air and water vapor to escape, and partly by drilling out the handle with a conical-tipped drill to provide an air-receiving expansion chamber at the bottom of the socket.

All parts are cleaned; then socket and end are coated with flux to insure good wetting by alloy.

The induction heating set-up which operates on an automatically-timed heating cycle, brazes three handles per minute. When the joint has solidified after a short cooling period, the still-warm flux is dissolved in a rinse tank under the brazing fixture.

INDUCTION unit for brazing joints. Heat increases capillary flow.



40% lighter*... a man can carry it in one hand

30% smaller... he can pass it through a 12" hole

powerful enough to go through 2" thick steel, 5" aluminum

*Weighs only 73 pounds . . . *without sacrificing protective lead-shielding (offbeam radiation level is only 7 mr per hour at 6 feet)*

You can get immediate delivery on a new ANDREX 160 KV lightweight portable unit.
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Picker X-Ray Corporation, 25 South Broadway, White Plains, N. Y.

PICKER... one stop for everything in industrial fluoroscopy and radiography

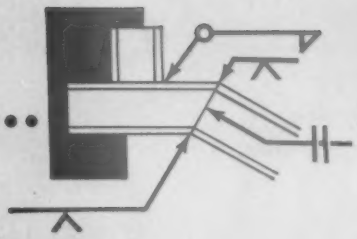
ANDREX lightweight portable x-ray units—130 KV, 160 KV, 200 KV, 260 KV and ***Andrescope*** X-ray Stress Analyzer.

PICKER x-ray units—5 to 50 KV, 150 KV (stationary and mobile), 270 KV portable, 260 KV heavy-duty, x-ray diffraction apparatus, rayproof inspection cabinets.

ACCESSORIES . . . films, tanks, darkroom sundries, illuminators, ***everything.***

TECHNICAL OPERATIONS units for isotope radiography—sources, equipment, containers for Iridium 192 Cobalt 60 and Thulium 170.

Picker x-ray



the welding clinic

Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

Industrial X-ray protection

Question:

The men in our shop have become quite concerned over possible dangers of radiation while working with X-ray equipment; in particular, sterility. What can we do to protect ourselves from these dangers?

Answer:

The problem of radiation, while quite serious, is apt to be overestimated by the layman. Following full protective measures and realizing the dangers of radiation will generally remove cause for worry among shop workers.

The government gives a detailed examination of radiation protection in handbooks published by the National Bureau of Standards—information which cannot be fully covered in this brief space. (You would do well, then, to obtain bulletins 50, 59, 60, and 61, which will cover the subject completely.)

Radiation Defined

First, let us define radiation. Radiation is a term comprising X-rays, gamma rays, high speed electrons, alpha and beta particles, neutrons, protons, and other nuclear particles. It does not include sound or radio waves, nor visible, infrared, or ultraviolet light.

You, of course, are dealing with X-rays. However, the suggestions below apply to all radioactive sources.

How much radiation can a man absorb and still be safe? The answer to this depends upon several factors: age of the individual, amount of radiation being emitted, and the body areas which are exposed.

Persons between the age of 18-45, who are in complete bodily contact with radiation over a period of years, may safely receive a *maximum* radiation dose of 0.1 r (Roentgen units) per week. Radiation is measured in the area normally occupied by the worker when the worker is not present.

Individuals over 45, however, when similarly exposed, may absorb twice this dosage, or 0.2 r.

At times, the worker comes in contact with radiation only through his hands, wrists, forearms, or feet and ankles. In this case, allowable dosage is 0.75 r.

Nevertheless, the two dosages cannot be combined. It is not safe for a worker whose extremities are exposed to a maximum dose to receive the full body dosage. Nor may the man whose whole body is exposed to radiation add extremity doses.

The situation is further clarified because of the differences between radiation permitted for medical purposes and industrial radiation. The X-ray operator, although taking a calculated risk at his job, is well protected by the government regulations when we consider that the average medical radiograph is 50 milliroentgen, or 0.5 roentgen.

Dangers of radiation are not always found in direct (primary) exposure; often, scattered radiation is most dangerous. This effect is caused when X-rays are not totally absorbed by work pieces and ricochet. The operator, who feels safe standing beside the machine, is not struck by the primary ray, but by equally invisible, scattered radiation particles.

But radiation protective devices are not designed for the operator alone. By their nature, X-rays cover a wide area and it is necessary to protect all workers in the room with the machine.

Best protection for non-operators is isolation of the machine. However, this is not always practical, so one of several methods must be used to measure the amount of radiation an individual receives.

The least expensive radiation detecter is a dental film packet. Both sides of one end of the packet are wrapped with lead and worn in the breast pocket—tube side away from the body. After a period of 15 consecutive working days, if the packet shows an image of the lead protective device when it is developed, additional protective measures should be taken.

Pocket chambers or pocket dosimeters are other individual monitoring devices. *Periodic blood counts cannot be considered a substitute for this type of radiation monitoring.*

Protective Materials

The X-ray tube should be surrounded by a protective covering to hold radiation leakage to a minimum. Ceiling, walls, and floors should be made of a protective material, usually lead, lead alloy, or concrete. Protective aprons and gloves also help in providing radiation defense.

As mentioned above, most radiation problems are caused by scattered, rather than primary, rays. Additional protection will be given to the operator if he is completely shielded during an exposure. A lead wall attached to the machine behind which he could conceal himself would serve this purpose.

In summary, remember: adequate protection from X-rays is more soothing than the fear of X-rays.

Hard faced with Rexwald VT, die pot liners like this one increased production by three times. Customer: J. W. Rex & Co., Lansdale, Pa.

Rexweld VT yields three times the forgings of best competitive alloy

In tests to determine which hard facing material yields the greatest number of forgings, one user reports that Crucible Rexweld VT outperformed the next best competitive alloy by almost three to one. They are now using Rexweld VT to rebuild and protect crucial die pot liners, like the one shown above, that is used to forge heavy shells for the Navy.

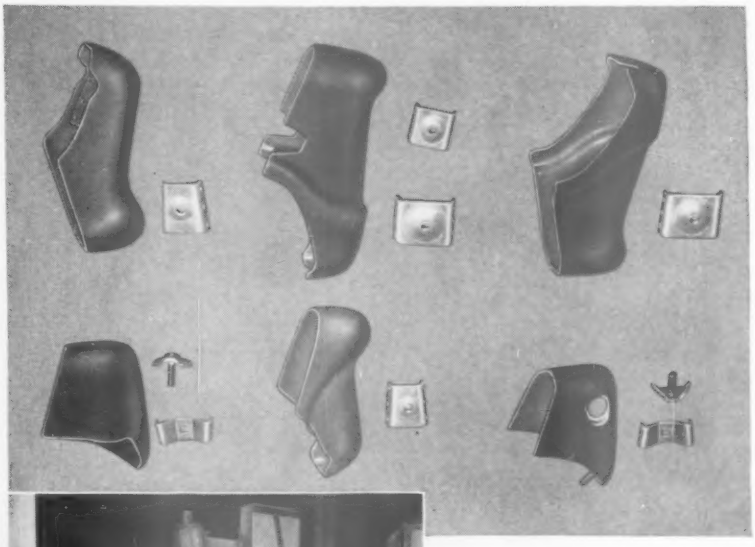
The tests illustrate many of Rexweld's superior properties: Higher resistance to thermal shock . . . Higher red hardness above 1600F . . . Measurable elongation up to 5%. These are reasons why Rexwelded dies have higher strength, and resist chipping, deformation and heat checking.

Rexweld hard surfacing rods are available in both bare and low hydrogen coated electrodes, in a wide variety of sizes and grades. Your local Crucible representative can give you more information on how Rexweld helps increase production, lower down-time, and cut manufacturing and maintenance costs. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

1 specially-tooled T-W welder assembles 15 bumper guards



This custom-built projection welder assembles 15 different models of auto bumper guards at a rate of 300 per hour. One or two mounting brackets are projection-welded on both sides of each guard. Simplified tooling changeover has cut down time 50%.

Specially-designed resistance welders speed assembly of many products that are similar — yet different. Custom tooling provides the answer. Designed for rapid changeover, special tooling reduces down time and lowers unit cost. It also permits economical modification for producing redesigned models. The result is a savings in capital investment and operating costs. For information on reducing your assembly costs now — and year after year, call the nearest Taylor-Winfield office, listed below.

The TAYLOR·WINFIELD *Corporation*
WARREN, OHIO

ELECTRIC RESISTANCE AND ARC WELDING MACHINES

Sales and Service

CHARLOTTE • CHATTANOOGA • CHICAGO • CLEVELAND • DALLAS
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SOME of the equipment needed for copper enameling. Note air-acetylene torch.

Weldors are using

Torches for pleasure, too

MANY PEOPLE are finding enjoyment in the art of copper enameling. Here is an art which the beginner learns easily . . . yet it gives pleasure to the most advanced craftsman.

The enameling process is simple. A copper artform is covered with an enamel base. The enamel is fired into the base, more enamel is added for decorative effects, and is in turn fused into the copper.

In the past it was mandatory, for proper baking of enamel, to have a kiln. Now, however, air-acetylene torches can be substituted for the expensive oven, and weldors who have access to proper equipment are able to create articles such as those pictured above. In addition to welding apparatus, the basic tools for enameling are shown.

Steps in Enameling

Clean the copper with a solution of one part nitric acid to five parts water—or use an abrasive eraser or steel wool. Paint a thin coat of enameling oil on the edges to prevent enameling powder from running.

Using an 80-mesh sifter, distribute enamel powder 1/32-in. thick over the copper base, starting from the edges and working toward the middle. When the copper is evenly covered,

place the piece on a screen over the firing stand.

For melting the first coat of enamel into the base use a multiflame tip at 5-8 psi. Fire with a short heat cone about ½-in. below the form and move down slowly to the outer cone until the copper becomes a bright red. At this point the enamel should fuse into the base. Allow the part to cool completely. The copper is now ready to be decorated.

Books to Aid You

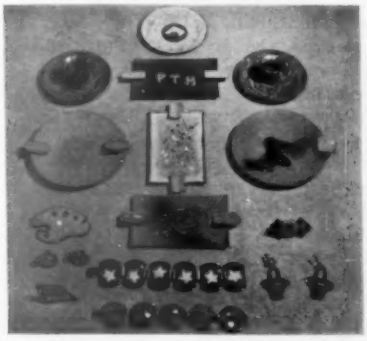
There are many types of designs which can be applied, and assistance will be found in *Enameling Principles and Practices* by Kenneth F. Bates, a comprehensive text which can be found in most libraries. A booklet published by American Art Clay Co., 4717 W. 16th St., Indianapolis, Ind., *Metal Enameling*, costs 25¢ and includes an equipment and supply catalogue.

A simple pattern for newcomers to the art is formed by using enamel threads and lumps. Use no lump larger than ⅛ in. in diameter. Place the lumps on the base and, when melted, use a swirling tool (1/6-in. stainless steel rod with a sharp point) heated red-hot. If the tip is placed in a color area and drawn off into a base area, there will be an attractive curve design.

If enamel threads are used the swirling tool technique is equally effective.

Stencils often give interesting designs, or allow you to initial the object being worked upon. A stencil is placed over the portion to be decorated; enamel of various colors is sifted into the openings. The last step is to remove the stencil and fire the piece.

BELOW: Some interesting and useful articles to be made.



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PLANTS: Keokuk, Iowa; Pryor, Oklahoma; and Shawinigan Falls, Quebec, Canada

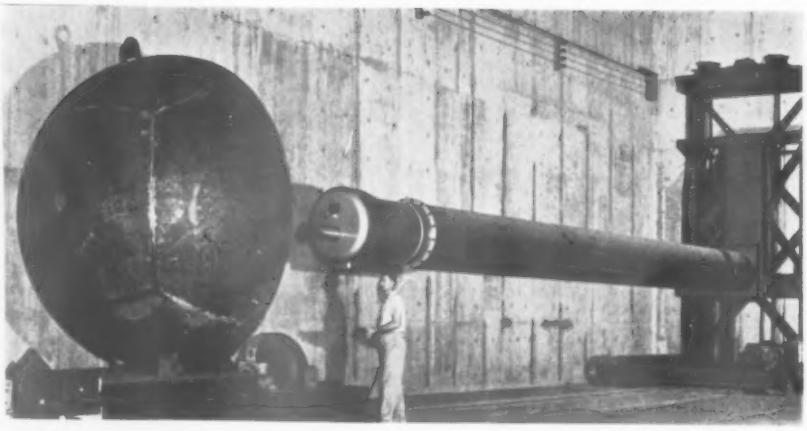
Foundry Saves 12½ Hours With Arcair

Vancouver Iron Works, in British Columbia, uses the Arcair Process for removing excess metal from reaction-type turbine castings —"used to take 14 hours to remove the 2¾" thick, 6" high, 16" long metal. Arcair does it in 1½ hours and no cleanup is needed." Savings on overall preparation cost — 65%. This is typical of many jobs throughout industry where the Arcair process saves both time and costs. The process consists of a torch, a special type of electrode, ordinary shop air and an ordinary D.C. welding machine.

To help you cut costs over chipping and grinding, ask your Arcair dealer for an on-the-job demonstration, or write today for the case history booklet.

Arcair COMPANY
P. O. BOX 431, LANCASTER, OHIO
P. O. BOX 4227, BREMERTON, WASH.

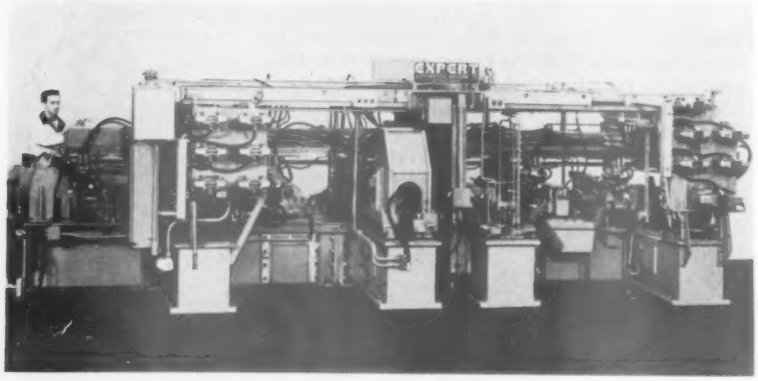
THIS giant machine, resembling a billiard cue and ball, is actually a 1-million volt X-ray inspector. It is used by Chicago Bridge & Iron Co. for nondestructive inspection of welded shell seams in heavy wall pressure vessels. Mounted on rails, the instrument is fixed on the end of a 43-ft counterweighted boom. It is housed in extra-thick concrete. ▶



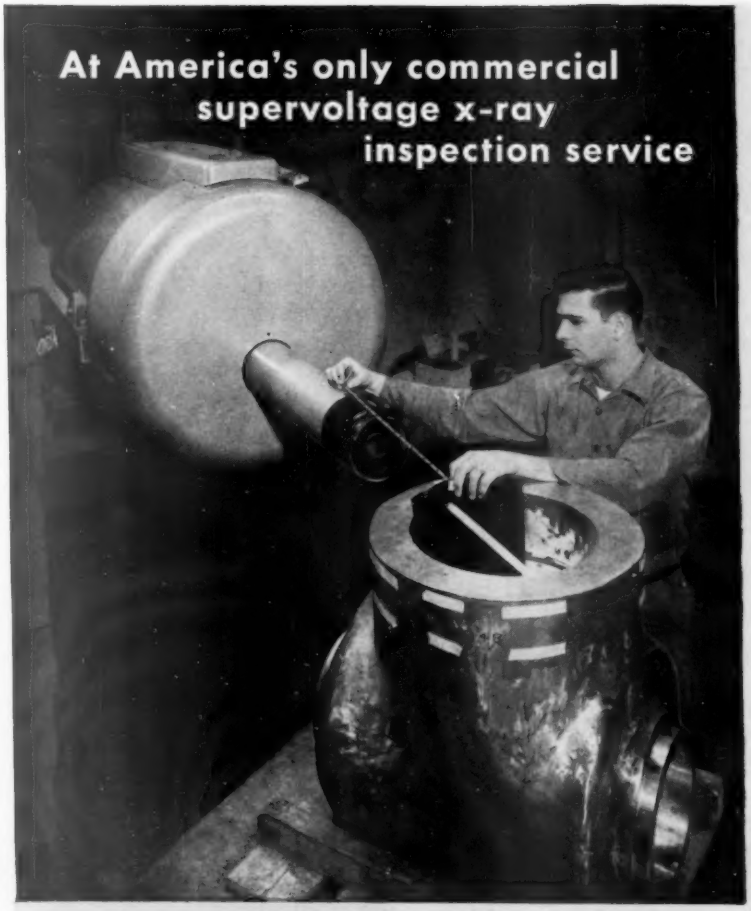
On the job . . .

TECHNICIANS apply 24 radiographs at six weld panel points during the construction of a New York office building. The 70-ft girder is a 36 in. ▼ flange beam weighing 300 lb per sq ft.

◀ ACETYLENE torch aids GM research scientists in testing heat and vibration effects on turbine blades for jet aircraft. Torch rotates blades in determination of thermal shock.



◀ A MACHINE which assembles, welds, machines, and *tests* has been introduced by Expert Automation Machine Co. Used in the production of automotive steering columns, "Weldamation" turns out 400 units per hour. A flange is fixed and welded to one end of the tube, three separate machining operations are made on the other; then the unit tests the finished product. Adjustment controls allow quick changeovers. Weld is tested by axial pressure.



Van de Graaff X-RAYS SPEED UP RADIOGRAPHY

with

Short exposures on fine-grain film

1 minute for 2½" of steel,
with 1-Mev Model JR

1 minute for 5" of steel,
with 2-Mev Model AR

Penetrating power

up to 5" of steel with 1-Mev
up to 10" of steel with 2-Mev

At the testing laboratory of Arnold Greene & Co., Inc., Cambridge, Mass., a Model JR 1-Mev Van de Graaff is daily proving the advantages of supervoltage x-rays in the inspection of heavy castings and weldments.

Van de Graaff® supervoltage radiography gives you

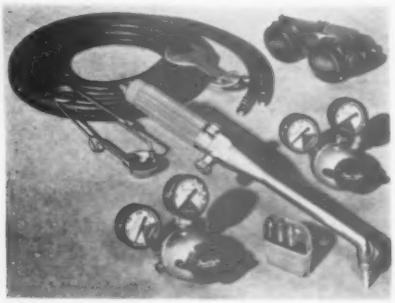
- **High radiographic quality** — Constant-potential point-source x-rays, from a focal spot only 1 mm in diameter, minimize scattering and give sharp definition.
- **Simplified installation** — The ability to use short radiographic distances without sacrifice of quality permits installation facilities to be compact and low-cost.
- **Lowest capital cost** for equipment in the supervoltage range.

For detailed information about supervoltage radiography — its costs, advantages, operating techniques, and examples of results being obtained — *write for 24-page Bulletin R.*

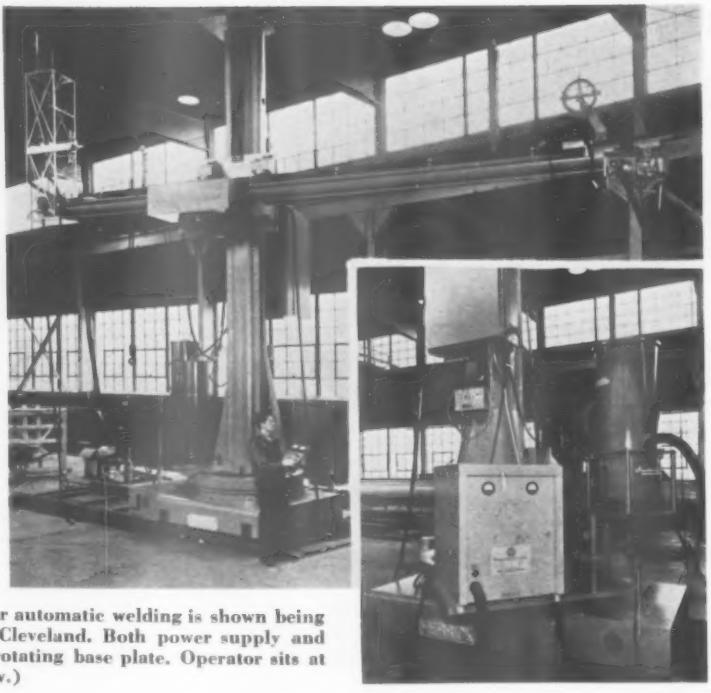
Panoramic radiography of 3½ inch thick steel weldment at Arnold Greene Testing Laboratory. A single, two-minute exposure from the 1-Mev Model JR Van de Graaff gives a complete set of radiographs that satisfy the rigid requirements of the atomic-energy industry.

HIGH VOLTAGE ENGINEERING
CORPORATION
BURLINGTON MASSACHUSETTS

new products . . . . . USE CARD ON PAGE 93



ABOVE: An improved model of a Linde welding and cutting outfit includes torch and regulators, four interchangeable tips (3 welding, 1 cutting), 12½ ft. length twin hose goggles, friction lighter and wrench. Outfit welds, cuts, heats and brazes without cutting attachment. (See story below.)



RIGHT: Heavy duty ram-type manipulator for automatic welding is shown being tested at C. B. Herrick Mfg. Co.'s plant in Cleveland. Both power supply and flux recovery equipment are mounted on a rotating base plate. Operator sits at the forward end of the ram. (See story below.)

Cutting outfit

IMPROVED model of a welding and cutting outfit is capable of welding up to ⅜-in. and cutting up to 2-in. Welds, cuts, heats and brazes without a cutting attachment. The new model has the cutting oxygen lever on top of the handle to be turned on and off with the thumb. A green plastic ring is around the oxygen valve and a red ring circles the acetylene valve for identification.

Non-clouding glass, held in place with a screw-type retaining ring, covers oxygen and acetylene regulators, eliminating the need for a new gage each time a crystal becomes damaged. Includes four interchangeable tips (3 welding, 1 cutting), 12½-ft length twin hose, goggles, friction lighter, wrench, and complete instructions. *Linde Co.*

Circle No. 1

Aluminum alloy

ALUMINUM metal-joining research turned up a new torch alloy to join poor fitting aluminum. It is an unusual bead-forming and thin-flowing alloy, designed for applications where joint design is not critical. Manufacturer claims advantages include its workability, since facing surfaces need not be parallel or close fitting. The alloy will bridge gaps, flow over rough surfaces and build up concave fillets, yet has sufficient capillarity to effect light gage T-joints.

Lower bonding temperature minimizes damaging metallurgical changes in base metals and danger of burn-through.

Exclusive pressure compacted extruded coating assures coating homogeneity and concentricity, uniform burn-off rate and less moisture pick-up, maker says. *Eutectic Welding Alloys Corp.*

Circle No. 2

Resistance welder

TWO new d-c power supplies for precision resistance welding use the stored energy principle to achieve extremely high ratings with low demand on power lines, firm says. Model 1101 is rated at 2,700 watt-seconds equivalent to 470 kva, and Model 1103 at 8,100 watt-seconds, equivalent to 2,626 kva.

High current density, precisely controlled and uniform from pulse to pulse, makes possible consistent welds at speeds up to 300 per minute. Metals with high electrical or thermal conductivity can be readily joined. Applications include hermetic weld sealing of transistor cases, precision welding of instruments, relays, etc.

Electronic control circuits of both units are identical. *Raytheon Mfg. Co.*

Circle No. 3

Manipulator

HEAVY duty ram-type manipulator for automatic welding has motorized vertical adjustment range of from 3 ft to 18 ft. Variable speed ram travel is 20 ft and it has a 360 deg rotation on the carriage. The welding head will enter a 24 in. diameter cylinder.

Controlled arc power supply gives constant voltage at the arc throughout welding. When combined with constant speed wire feed, variables in operation are eliminated, manufacturer says. Thus, higher deposition rates with more uniform deposits are gained, using less complicated welding controls.

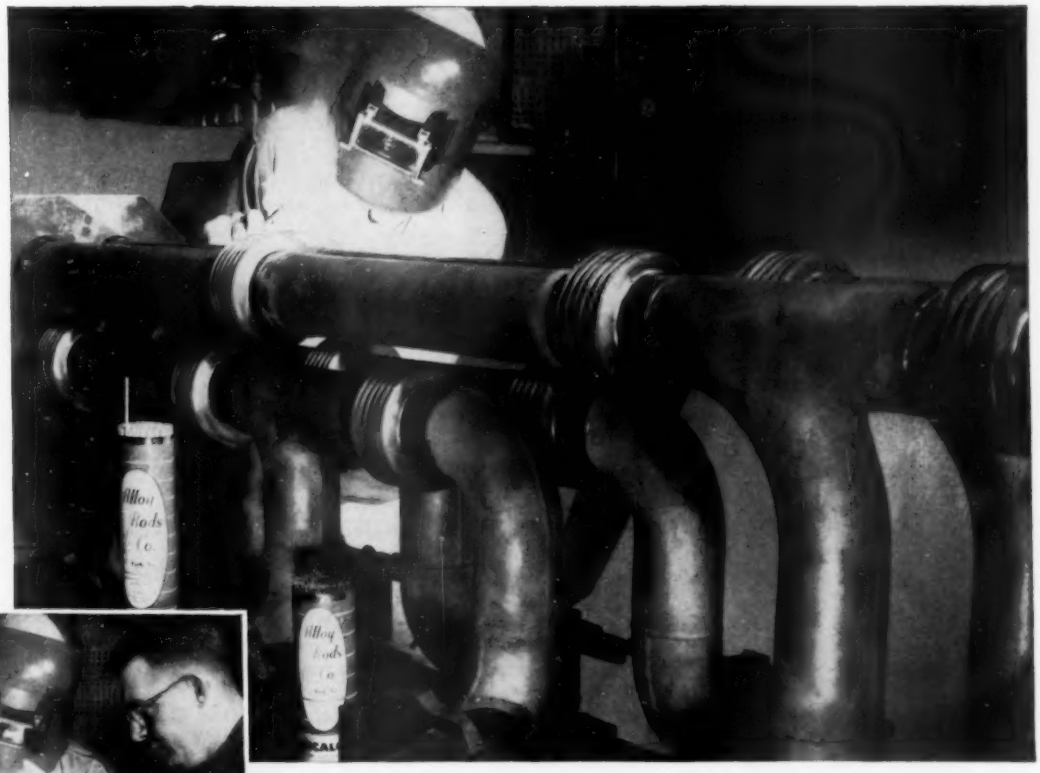
Power supply and flux recovery equipment are mounted on a rotating base plate. All manipulator and welding controls are in a portable pendant and are in actual use. Features an automatic flux feed, with flux fed through ram. Wire feed may be either from the rear or forward end of the ram. *Metal and Thermit Corp.*

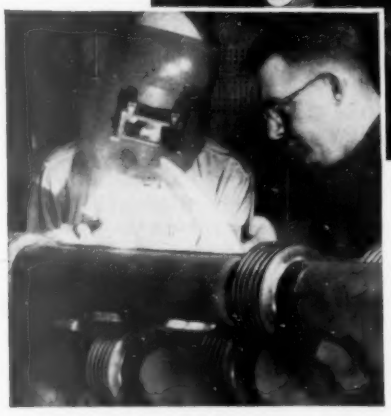
Circle No. 4

Valve

SPOOL solenoid pilot valve has life of 25,000,000 cycles. Sixth of series of pilot heads which can be mounted interchangeably on the seven Ross Skyline valve bodies. *Ross Operating Valve Co.*

Circle No. 5





Phil Hoener looks on as the weldor joins a bellows to the type 321 stainless manifold with Arcaloy type 347 electrodes

For maximum corrosion resistance at elevated temperatures . . .

HANLON & WILSON CO. selected

ARCALOY

STAINLESS STEEL ELECTRODES

Highly corrosive diesel fumes at temperatures up to 1300° F. is the reason why Philip Hoener, Shop Superintendent, specified Arcaloy 347 AC-DC electrodes for the welds in this new stainless steel manifold for diesel engines.

Hanlon & Wilson Company, Pittsburgh, Pa., are the developers and manufacturers of this revolutionary, exceedingly superior manifold design which more than doubles the service cycle of railroad diesel engines.

The key to this development is a series of stainless steel bellows of unique design. Fourteen of these bellows working on a horizontal sleeve arrangement have eliminated failures caused by expansion and contraction, vibration, gas pressures and of course, corrosion.

There are 25 grades of Arcaloy stainless steel electrodes, in lime or AC-DC coatings, that will improve your product . . . provide a better quality weld metal. Write for a copy of bulletin AR-10, the selector guide to superior quality stainless steel weld metal.

Alloy Rods Co.

General Offices and Plant
Lincoln Highway West
YORK 2, PENNSYLVANIA

Pacific Coast Sales Office and Plant
750 Lairport Street
EL SEGUNDO, CALIF.

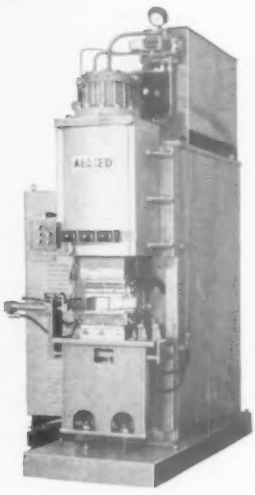
NO FINER ELECTRODES MADE . . . ANYWHERE

Since you're looking for better tools . . .

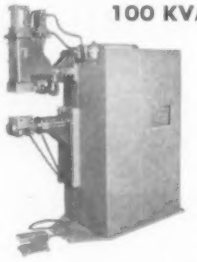
. . . LET'S TALK STANDARD WELDERS!

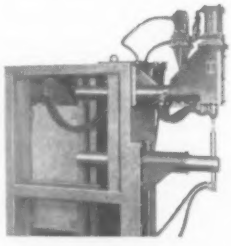
Allied's new roller head press type combination spot and projection welder (lower illustrations) has 8 outstanding advantages. Standard models are approximately one foot less in width than conventional welders, accomplished by placing arms off-center with controls installed within chassis frame where protected. Arms can be installed left or right of center making possible convenient welding of irregular-shaped pieces that fit naturally around corner of machine. Machines with right and left hand mounted arms may be installed adjacent to each other and within 9½" for sequence welding. Arms may be extended by simply loosening 3 screws on casting to give up to 30" throat depth. Vertical adjustment of lower arm up to 15" is provided without changing current characteristics except on air gap since transformer is connected directly to arm support casting instead of mounting plate. By removing 4 bolts, head may be replaced with special adaptations such as multiple guns or projection welding platens. This is done in minutes on the job. Welders are completely water cooled with open or closed circuits. Available in standard sizes: 30, 50 and 75 KVA with 1000 P.S.I. at 80 lbs. line pressure and 75, 100 and 150 KVA with 2300 P.S.I. at 80 lbs. line pressure and on up to 750 KVA in press welders (top). Prices are well below that of conventional welders of equal capacity.

750 KVA



100 KVA

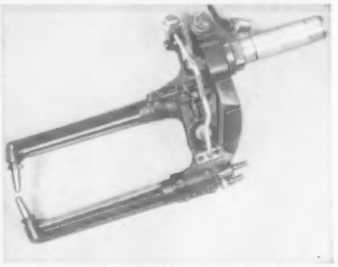


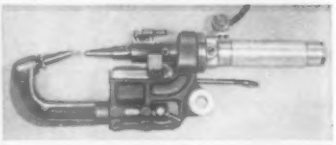


Write for information.

. . . LET'S TALK WELDING GUNS!

Operation so cool you can hold your hand on the jaw extension right below the point is main feature of this new line of portable guns. Incoming water reaches point through tube insulated almost its entire length from metal of jaw by return water jacket which has 5 times capacity of in-flow tube. Heat transfer to the in-flow tube is much less than with small diameter cast-in return water tubes that build up excessive heat in the jaw extension. Use contact fulcrum pin in place of conventional shunt which tends to overheat causing early failure Built-in guide for moving jaw prevents wear on fulcrum pin if gun is used in cocked position. Line includes "C" and scissors type with upper or lower jaw operating and types for special applications. Guns have been on heavy duty production test for 2 years.





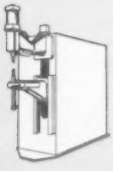
YOUR SPECIAL EQUIPMENT PROBLEM — *HOW BIG IS IT . . . REALLY?*

If it involves special equipment for a production welding operation it may not be a problem at all—just an assignment when placed in competent hands.

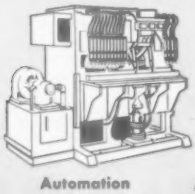
This is our kind of work—we specialize in it—do it every day; designing and building special machines for welding everything from bathtubs to trailers, frequently including provisions for automatic handling and transfer where the job is a part of a production line set-up.

We're no brain trust here at Allied Welder, but we keep some awfully important production people happy with our creative designing and manufacturing know-how—delivery, too.

May we work with you on your next job?

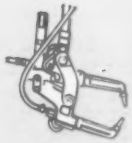


Standard Welders



Special Welders

Automation Equipment

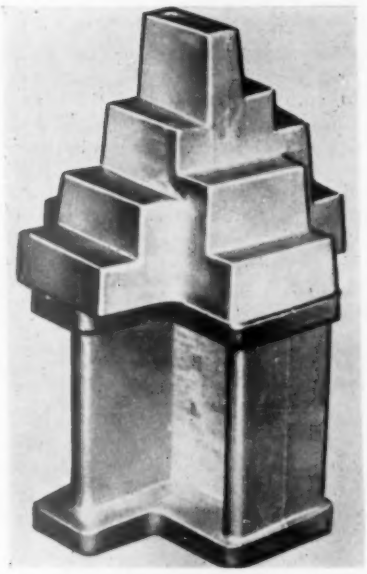


Automatic Arc Welders

Welding Guns

ALLIED WELDER CORPORATION
8700 BRANDT DEARBORN, MICHIGAN

Creative Design



Protective blocks

MULTI-step set up blocks are soft enough to prevent damage to machine table finish, yet strong enough to withstand heavy weights under clamping pressure, says the manufacturer. Blocks are mounted on 3 in. risers, hold work from 0 to 3 in. and can be pyramided to any desired height. The "T" base riser blocks require a minimum of table space but maintain complete rigidity at all heights. Each block and riser is interlocked by a boss and cavity.

Blocks come in sets of 2 multi-step blocks and 2 risers per package. *Jergens Specialty Tool Co.*

Circle No. 6

Air hammer

BEEHIVE-type spring retainer for holding various tools is featured in a new air hammer. Operator can rotate the tool in any direction while the hammer is in use. Weighs only 3¼ lb, measures 8 in. and has a 3 in. piston stroke. Metering-type trigger controls hammer blows from 0-2,700 per minute.

Eleven hand-forged chisels are available for the hammer. *Superior Pneumatic & Mfg. Co., Inc.*

Circle No. 7

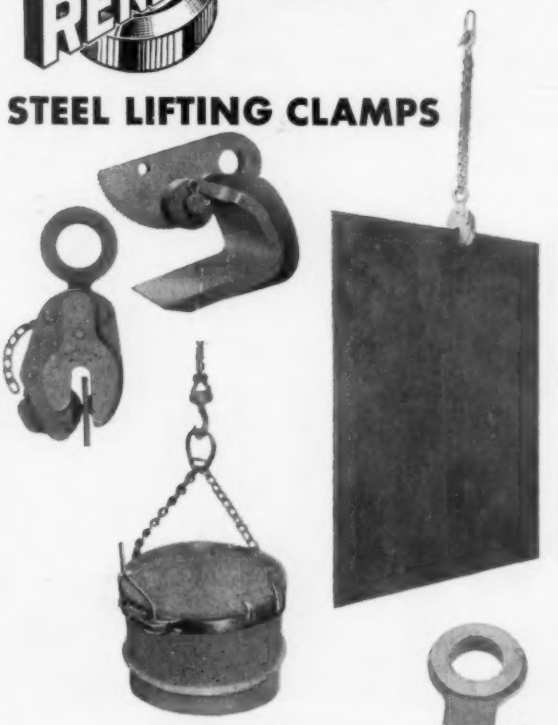
Cutting torch

FUEL savings and safety are claimed advantages of new "Browning" oxy-gasoline cutting torch. Oxygen consumption, after testing, is no more than with acetylene; gasoline cost is reportedly low. Kerf width and speed are said to be equal to other fuels. *Worcester Taper Pin Co., Inc.*

Circle No. 8

RENFROE Safety Snap Lock

STEEL LIFTING CLAMPS



HANDLE STEEL WITH SAFETY

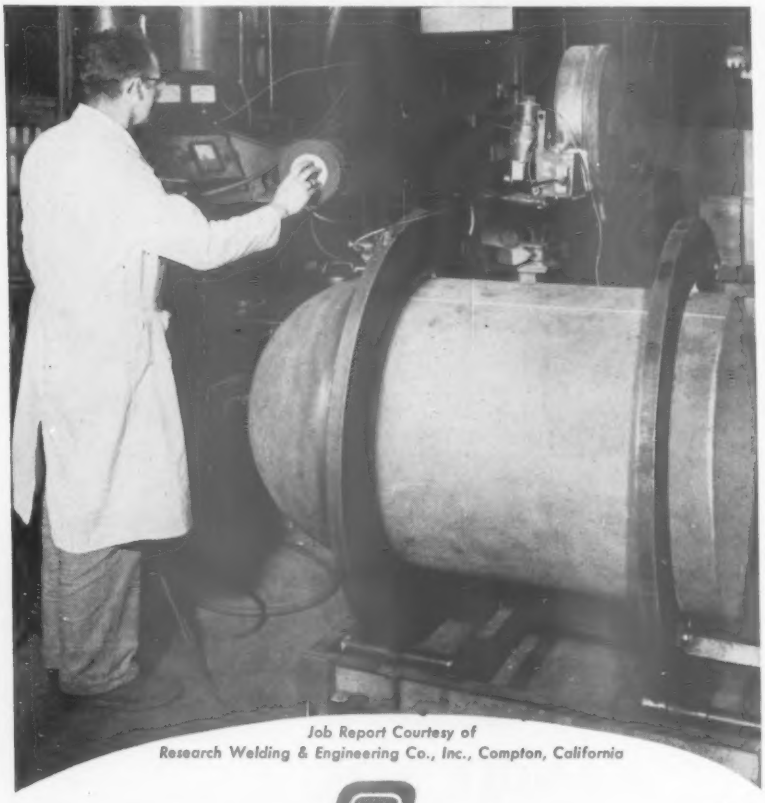
√ Maximum Speed and Safety
√ From ½ ton to 20 ton sizes
√ Lock on in any position
√ Lock off in any position
√ Exceptionally light in weight
√ The toughest clamp ever built
√ Takes the place of welded pad eyes and screw clamps
√ Cannot be accidentally knocked off
√ Safety Factor 5 to 1

A Superior Line of Steel Lifting Clamps designed to meet today's demand for handling steel with maximum SAFETY and EFFICIENCY.

WRITE FOR COMPLETE CATALOGUE

J. C. RENFROE & SONS, INC.
1259 WEST STATE STREET • P. O. BOX 4279
JACKSONVILLE, FLORIDA

For flawless high strength weld metal in missile components



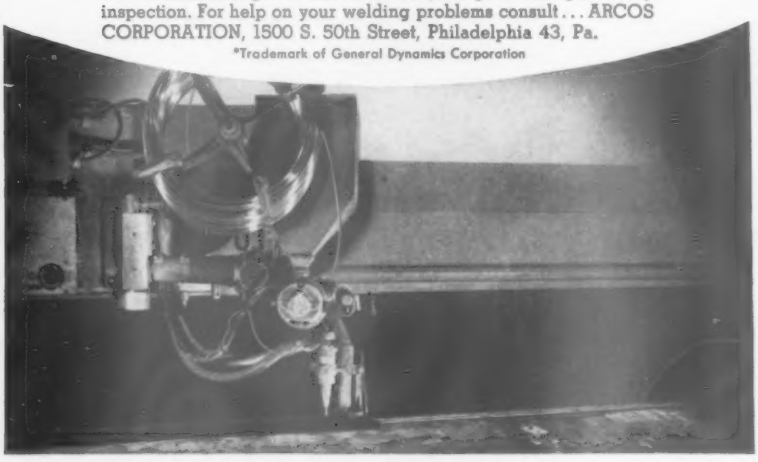
Job Report Courtesy of
Research Welding & Engineering Co., Inc., Compton, California

WELD WITH ARCOS

CHROMENAR Spooled Wire

Light weight was important in this welded missile component that was required to hold air under 3,000 p.s.i. pressure. After making the root pass weld with the Arcos EB* consumable insert, the weld was completed by submerged arc welding with Arcos CHROMENAR CMV welding quality wire. CHROMENAR CMV was selected because its weld metal could be heat treated to match the base metal with tensile strength in excess of 200,000 p.s.i. and pass x-ray inspection. For help on your welding problems consult... ARCOS CORPORATION, 1500 S. 50th Street, Philadelphia 43, Pa.

*Trademark of General Dynamics Corporation



Extinguisher

PRESSURIZED 2½ gallon fire extinguisher adapts "Karbaloy" extinguishing agent to a pressurized unit. Karbaloy is a non-freeze, non-toxic, high potency agent that fireproofs as it extinguishes, manufacturer says. Unit has press-lever control to conserve the extinguishing agent, stainless steel finish and can be installed in all standard extinguisher cabinets. Unit is effective against both class A and B fires. *Fyr-Fyter Co.*

Circle No. 9

Safety cloth

ALUMINIZED asbestos cloth is used for fire protection curtains in welding booths. Withstands heat exceeding 2,500 deg. Fire-protective cloth reflects over 90% of radiant heat. Can be exposed to direct flame with no damage. Tightly woven asbestos is surfaced with special process using heat reflective aluminum foil. "Kamklad" resists water and oils. *Keasbey and Mattison Co.*

Circle No. 10

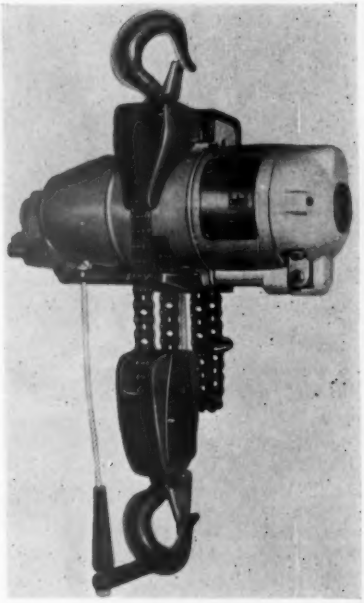
Traverse drive

VARIABLE speed transmission is for traverse applications on winding machinery. Drive provides infinite speed range with speed holding and reset. Special controls change traverse rates if necessary. Drive is compact and light. It can be had with variety of built-in reducers, both spur and worm gear types, with output shafts—horizontal or vertical, up or down. *Graham Transmissions, Inc.*

Circle No. 11

THIS "player piano" won't pound out the Jelly Roll Blues, but it will automatically weld as many as 1,600 spots on a jet engine part in less than one and a half hours. The welder is expected to save $26,000 annually in the manufacture of jet engines for defense. Insert a roll of tape, set the controls and the job is resistance welded in one-fourth the time required with a manually-operated welder. Directions and positions are programmed on punched paper tape. *General Electric*

Circle No. 12



Air-powered hoist

CAPACITY air-powered hoist weighs 4,000 lb, is fitted with either roller or link chain. Lifting and lowering speed varies from creep to 10 ft per minute at full load and 90 psi airline pressure. Length of lift is 8 ft. Hoist operates with one-hand control bar or remote pendent control, weighs 100 lb and is equipped with swivel-mounted safety suspension and load hooks. Accessories include trolleys, chain basket with 20-ft capacity, filter-regulator-lubricator and non-sparking kit to adapt hoist for operation in explosive atmospheres. *Gardner-Denver Co.*

Circle No. 13

Safety spray

CONTAINS oils which have been successful in treating burns, manufacturer says about new safety spray. Aids growth of new tissue while relieving pain. "Burn-Quel Aerosol Burn Spray" is packed in non-breakable 2 oz aerosol bottle. *A. E. Halperin Co., Inc.*

Circle No. 14

Cleaning compound

CLEANING compound "Nocaust-NC-200," is clean-to-handle, dustless, free-flowing powder. Highly alkaline, it contains no free caustic or inert material. An all-purpose detergent, it can be used in metal degreasing, cleaning of metals wherever such an agent is required. Compound is water soluble. *John B. Moore Corp.*

Circle No. 15

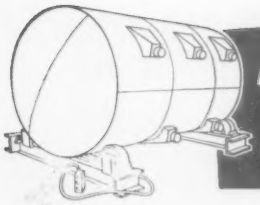
This WELDED nuclear pressure vessel holds a practical idea for you

Job Report Courtesy of
Combustion Engineering, Inc., builder of vessel shown

USE ARCOSITE FLUX

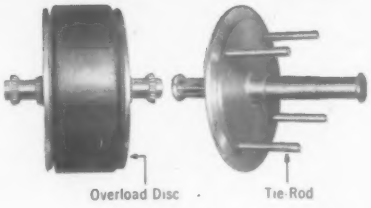
for submerged arc welding

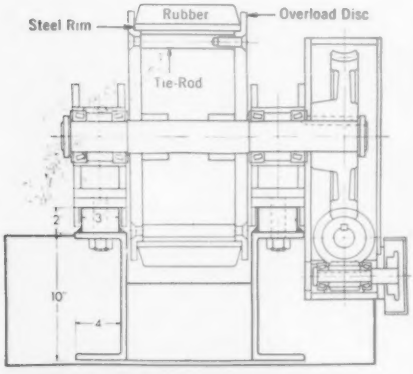
In nuclear installations where radio activity makes weld failure dangerous to personnel and can cause indefinite shutdown, sound corrosion resistant welds are of utmost importance. To inhibit corrosion, portions of the 9 ft. dia. interior of this 33 ft. reactor were overlaid with ¼ in. of 308L weld metal. Submerged arc welding with ARCOSITE S4 flux was used for the job. The girth and longitudinal joints of the low alloy steel plates were also submerged arc welded using ARCOSITE B5 flux. Cost-wise, no other conventional method of cladding was practical. Arcos weld metal quality guarantees corrosion resistance . . . freedom from maintenance.
ARCOS CORPORATION, 1500 S. 50th Street, Philadelphia 43, Pa.



ARONSON TURNING ROLLS
with these PLUS FEATURES
cost no more than ordinary rolls!

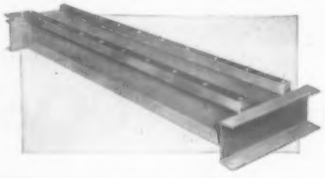
Today there is need of Turning Rolls that will give everlasting continuous service to meet the needs of high production and precision welding techniques — ARONSON fills that need.





- The **OVERLOAD DISCS** of steel provide maximum traction and prevent ever crushing or wearing out tires.
- The **ANTI-FRICTION BEARINGS** can carry four times the rated load.
- **TIE-ROD AXLE** design forms an effective axle as large in diameter as the O. D. of the steel tire rim.
- **PRECISION STEEL WAYS** guarantee perfect alignment of all wheels to hold work exactly true.

NO USER HAS EVER HAD TO CHANGE A TIRE ON AN ARONSON TURNING ROLL



POSITIONEERING *with* **Aronson**

UNIVERSAL BALANCE® POSITIONERS
BENCH TURNTABLE POSITIONERS
GEAR DRIVEN POSITIONERS
HEADSTOCK-TAILSTOCK POSITIONERS
TRACTRED® TURNING ROLLS
RUBBER-TIRED TURNING ROLLS
RAIL CAR POSITIONERS • TURNTABLES
FULLY AUTOMATIC POSITIONERS
MAGNETIC WELDING CLAMPS

ARONSON offers you over 200 PROVEN Standard Stock Models of Quality POSITIONERS "POSITIONEERED" to your exact requirements

Write for detailed engineering data

Quality POSITIONERS by **Aronson MACHINE COMPANY**
ARCADE, NEW YORK

Tig gun

DESIGNED to bridge the gap between resistance and arc welding, the "Tec Spot Gun" utilizes Tig welding. Besides its use of power sources with built in spot gun controls, the Tec introduces a second welding timer, built into the gun itself. This timer gives a selection of weld depth penetration of any two joint applications in one production line, without returning to the power source for readjustments.

Gun enables Tig spot welding of all joints that can be resistant spot welded, plus spot welding of all gage thickness joints accessible from only one side, inside or outside corner, "T" joints, butt, inside and outside flange, etc. *Tec Torch Co., Inc.*

Circle No. 16

Lighting unit

TOPPED by three 5,000 candle-power sealed-beam lamps which provide light for six hours, a self-contained "Sentry-lite" is automatic for emergency use in large areas. It features an automatic recharger operating on standard electrical power to keep the battery to peak capacity. Dimensions are 8 by 10 by 13 in. *American Optical Co.*

Circle No. 17

Cutting unit

CAPABLE of cutting 20 in. pipe, a newly designed machine has a cut surface finish suitable for gasket face use. It can handle a 40 ft (double random length) or 20 in. pipe with wall thickness of 7/8 in. (provided first cut is 5 ft or more).

Hydraulic controls move the chucking drive up and down for centering. Locking system which holds the chuck in proper length position is hydraulic. Chucking device movement, rotation and cutting units are electrical. *Wallace Supplies Mfg. Co.*

Circle No. 18

Tungsten-arc welding with Inco "62" Filler Wire results in strong, corrosion-resisting joints in Inconel alloy. Among the precautions Elano Corporation, Dayton, Ohio, takes on this job for the AEC are vapor-degreasing, CC14 rinse, glove-handed set-up of all parts . . . dye-penetrant-testing of every bead deposited.

How to make AEC-quality welds in Inconel pump to handle molten metals

Elano Corporation fabricates a remarkable pump for the Atomic Energy Commission.

It's seal-less . . . absolutely leak-proof. It circulates corrosive reactor "coolants" at high pressure: aggressive, high-purity water or liquid metals as hot as 1800°F.

To stand up in this service, all parts that come in contact with the "coolants" are Inconel* nickel-chromium alloy.

AEC standards require joints in the Inconel components that are as corrosion-resisting as the base metal . . . just as strong and ductile. Here's how Elano gets this AEC quality:

First, they use the inert gas tungsten arc process. That eliminates need for flux . . . a possible cause of corrosion at elevated temperatures.

Second, they weld with "62" Inconel* Filler Wire. This filler metal is produced by the men who produce Inconel alloy . . . naturally gives the best possible match with the parent metal.

Third, they use a meticulously careful multiple-pass welding technique. With low arc voltage (and low heat input), weldors lay down straight, narrow beads . . . hold welding speed to less than one inch a minute . . . avoid weaving.

This procedure preserves Inconel alloy's important deoxidizing elements...and minimizes grain growth in the base metal. End result: welds are sound . . . strong . . . ductile. They possess uniform structure . . . high corrosion resistance.

You take a giant step towards filling the "specs"... whatever they are . . . when you weld Inco Nickel Alloys with *Inco Welding Products.*

Take the *first* step now. Write for your copy of a useful booklet that describes *all* these electrodes, wires, rods, and fluxes. It's called "Inco Welding Products." *Registered trademark

The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

INCO **Welding Products** Electrodes Wires Fluxes

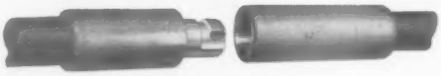
To solve these welding problems...

Specify cam-lok

for SAFETY • SPEED • ECONOMY

Reducing overheating and current losses with positive lock CABLE CONNECTORS *that release easily*

EXCLUSIVE CAM-ACTION
Fibre Insulated
CABLE CONNECTORS



- Minimum resistance, high pressure contact.
- Lock tight—stay tight—release easily.
- Self-compensating for wear.

Producing indestructible shockproof waterproof CABLE CONNECTORS *in minutes*

cam-lok *Neoprene Insulated*
CABLE CONNECTORS

- Eliminate cable breakage at connector. Cable jacket cannot pull away. Connection smoothly tapered—won't be caught on obstructions.
- Minimum resistance when locked, yet quick disconnect. Connects all cables, #2—4/0.
- Sleeves are permanently vulcanized to cable jacket with Vulcanizing Kit.

Quickly producing vulcanized economical CABLE SPLICES AND CONNECTORS *without power loss*

cam-lok *Portable*
VULCANIZING KIT

- Produces a neoprene insulated cable Splice or Connector in 5 minutes, in 5 easy steps.
- Waterproof and shockproof connection . . . conductivity and insulation equal to newcable. Kit operates on 110 V. AC.

Making economical, vulcanized CABLE SPLICES *in minutes*

cam-lok *Neoprene Insulated*
CABLE SPLICES

- Each Splice is uniformly smooth . . . permanent . . . waterproof . . . safe . . . delivers full power.
- Economical . . . you can splice as little as two, 2′ sections together economically, which might otherwise be wasted.

cam-lok
DIVISION
EMPIRE PRODUCTS, INC.
P.O. BOX N-98, CINCINNATI 36, OHIO

Write for catalog and prices on the complete line of CAM-LOK Welding accessories and supplies.

Detergent

INDUSTRIAL detergent is a clear solvent designed to remove grease, oil and smut from machinery where water cannot be used. Termed "Composition No. 117," the new material has a flash point of 185 deg, Cleveland open cup.

Detergent is used full strength, applied by brush, or immersion, or a non-atomizing spray. No rinse is necessary, states the manufacturer; parts may be blown dry with compressed air. *Oakite Products, Inc.*

Circle No. 19

Welder

RECTIFIER type d-c welder features new transformer, weld stabilized circuit and completely sealed semi-metallic rectifier. Firm says "Gold Star SR" delivers maximum arc stability, with electrodes in all positions, for greater metal deposition.

Higher short circuiting current enables pinching the arc in vertical and overhead welding, company claims. *Miller Electric Mfg. Co.*

Circle No. 20

Catwalk

INSTEAD of an operator's pulpit, a welding head manipulator is now equipped with a catwalk which is removable for welding inside small diameters.

The manipulator "RBM" has an arc height of 12 ft, horizontal arc travel of 12 ft and is mounted on self-propelled travel car with 360 deg manual rotation of column. Welding power source and flux recovery system are mounted on bracket attached to the column. All controls (welding, turning roll or positioner) are mounted at the end of the boom.

The catwalk allows inspection of welds during the actual operation. *Pandjiris Welding Co.*

Circle No. 21

Are you interested in ULTRA HIGH PURITY ARGON

...in quantity...at minimum price?

Ultra High Purity Argon—we at Air Products call it U.H.P. Argon—has a purity in excess of 99.995% . . . reduces the danger of undesirable oxidation in inert gas shielded arc welding more effectively than commercial grade argon. This "research" grade gas supplied by Air Products in commercial quantities affords superior control of the weld pool and of the arc . . . less clouding and a better view.

Produced by Air Products' low-temperature processing plants, U.H.P. Argon is also used as an inert protecting atmosphere in the sintering of metal powders such as titanium and zirconium . . . drawing of tungsten wire and filaments . . . fabrication of high-speed, metal-cutting tools . . . reduction of titanium and zirconium tetrachloride with magnesium.

We produce U.H.P. Argon and other industrial gases such as oxygen, nitrogen and hydrogen. We supply these gases in practically any combination of states, purities and pressures. We design, manufacture, erect and operate low-temperature processing equipment: package, tonnage and custom-built industrial gas separation, liquefaction and purification systems.

Have you a use for U.H.P. Argon . . . at competitive prices and in from cylinder to tank car quantities? Let us know if you're interested, and what your requirements may be. Air Products, Incorporated, P.O. Box 538, Allentown, Pa.

Air Products
...INCORPORATED

CUT COSTLY DOWN TIME

...get stronger welds faster with Bridgeport No. 192 Low-Fuming Bronze Rod

A cast steel valve chamber, controlling fluid from a 1200 psi pump, spelled shutdown for an entire operation when it developed a crack. Instead of replacing the unit at considerable expense in both money and time, a shop welder repaired it quickly, cheaply and permanently with Bridgeport No. 192 Low-Fuming Bronze Rod.

Bridgeport No. 192—recommended for all-purpose welding—is a low-fuming manganese-type rod that tins readily with only local preheating. Because the temperature of the surrounding metal requires relatively little preheating, brittleness is avoided. This also means a saving in gas and labor, and often produces a weld stronger than the base metal.

You can have the whole money-saving story of Bridgeport No. 192 Low-Fuming Bronze Rod and other Bridgeport Alloys in our new booklet, "Bronze Welding—Modern Tool of Industry." Write for your free copy today.

HANDY GUIDE TO BRIDGEPORT WELDING ALLOYS

ALLOY	Welding Method	Approx. Melting Point °F
192 Low Fuming Manganese	GAS	1600
191 Manganese Bronze (Navy)	GAS	1600
196 Bridgeport Bronze	GAS	1600
656 Silicon Bronze (3% Si)	GAS or ARC	1865
548 Nickel Silver	GAS	1675

Bridgeport BRASS CO.

BRIDGEPORT BRASS

Offices in Principal Cities • Conveniently Located Warehouses

Bridgeport Brass Company, Bridgeport 2, Conn. • In Canada: Noranda Copper and Brass Ltd., Montreal

BRASS • BRONZE • COPPER • SHEET • ROD • WIRE • TUBE • ALUMINUM EXTRUSIONS AND FORGINGS

NEWS . . . . . *from page 6*

arched and center-pinned 80-ton trusses rest on 14-ton triangular haunches on either side, giving a free span of 267 feet, 4 in.

Haunches and trusses are of all-welded design, mostly shop fabricated by International Steel Co., Evansville.

Joints are either plain fillets or in the case of thick sections, deep-groove multipass welds. Flame-shaping and edge beveling preceded welding operations. The Lincoln Electric Co.'s iron powder electrodes, AWS types E6027, were used with a-c from combination a-c/d-c machines.

Canada scores "seamless" first

Reportedly the world's first automatic seamless steel tube plant has been opened in Sault Ste. Marie, Ontario by Mannesmann Tube Co., Ltd., a subsidiary of Germany's largest steel organization.

The $20 million mechanized mill will produce seamless tubes from steel rounds in a "push button" operation at the rate of 225,000 tons of tubes annually, company President Gerhard Wagner said. Located on a 35-acre site, the windowless building is steel. Only a half-mile from St. Mary's river, a link in the St. Lawrence seaway, products can be water transported to the Texas oil fields via Chicago and the Mississippi River.

Olin Aluminum grows and grows

When production starts next year at a huge fabrication plant in the Ohio River Valley, Olin Mathieson reportedly will be one of the nation's four major aluminum fabricators.

Atlanta, Ga. is the site of Olin Aluminum's first U. S. district sales office, which will serve as the company's southern sales headquarters.

Four plants are now in operation: Chattanooga, Tenn., East Alton, Ill., Gulfport, Miss., and Riverside, Calif.

Liquid Oxygen plant supplies Pacific Northwest

Reportedly the first liquid oxygen, nitrogen and argon producing plant in the Pacific Northwest is now in production. The 25-ton Industrial Air Products Co. plant has been under construction for 18 months.

Four new liquid oxygen trailers can deliver large quantities of the gases. Each has a capacity equal to 450,000 cu ft of oxygen, compared to the usual trailer equipped to carry 250 cylinders.

Automatic Aircomatic® welding of longitudinal seam with CO_2.

CO_2...low cost gas shield for metal arc welding

Carbon dioxide is fast gaining acceptance as a most economical shielding medium among fabricators of arc welded mild steel. It's ideal for single or multi-pass applications . . . *manually* or *automatically*.

Pureco Technical Sales Service can give you all the information you need about CO_2 in welding. Call your Pureco representative today! There are more than 100 locations from coast to coast for your convenience.

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AN AIR REDUCTION PRODUCT

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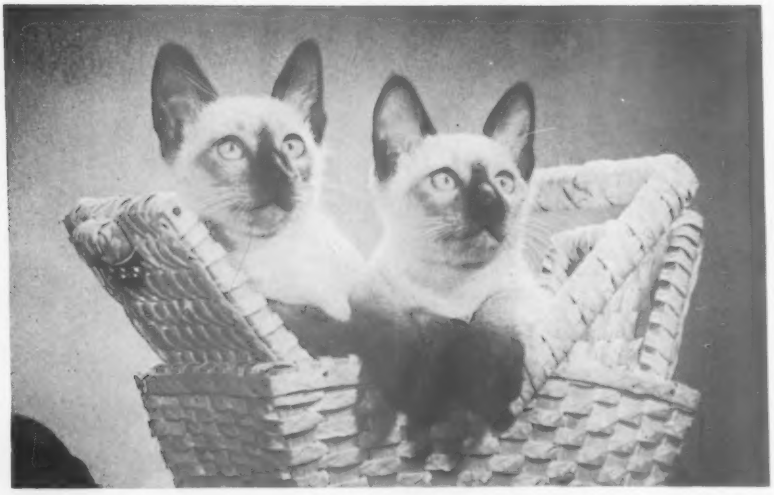
Pure Carbonic Company

NATIONWIDE "DRY-ICE" SERVICE-DISTRIBUTING STATIONS IN PRINCIPAL CITIES

GENERAL OFFICES: 150 EAST 42ND STREET, NEW YORK 17, N. Y.

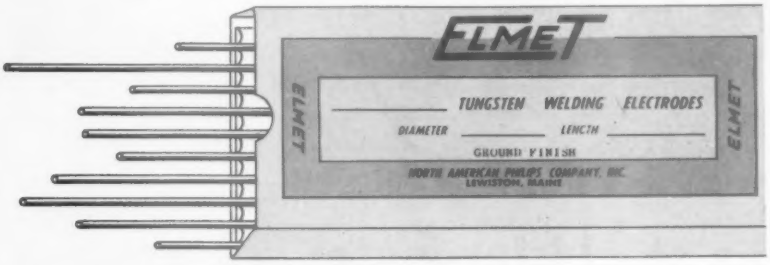
PURE CARBONIC COMPANY is a division of **AIR REDUCTION COMPANY, INCORPORATED** • Principal products of other divisions include: **AIRCO** — industrial gases, welding and cutting equipment and acetylenic chemicals • **OHIO** — medical gases and hospital equipment • **NATIONAL CARBIDE** — pipeline acetylene and calcium carbide • **COLTON** — polyvinyl acetates, alcohols and other synthetic resins.



ALIKE AS TWO ELMET ELECTRODES

Nature does it without even trying, but on the production line it takes a lot of human skill to attain absolute uniformity. In the making of Elmet tungsten electrodes, however, the result is well worth the extra effort. For Elmet electrodes are completely uniform, not only in surface finish and dimensions, but more important, in their composition, characteristics and physical structure. This means that, with Elmet, you get consistently superior performance from electrode to electrode with a minimum in readjustment of equipment and voltage.

Elmet pure tungsten and thoriated tungsten electrodes are furnished in cleaned finish and in the mirror-smooth centerless ground finish. They are available in packages of 10 in all standard diameters from .040" to ¼" and from 3" to 18" in length.



Why not place a trial order with your distributor today, or use the coupon below to obtain full information and an informative folder on tungsten electrode welding.

NORTH AMERICAN PHILIPS COMPANY, INC., Elmet Division, Lewiston, Maine

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We are a Distributor ☐ User ☐

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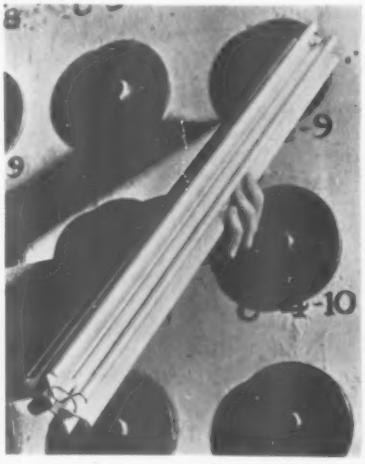
Metalweld named Teflon applicator

Protective Coatings Div. of Metalweld, Inc., Philadelphia, has been appointed certified applicator for the newly-perfected line of cementable Teflon produced by U.S. Gasket Co.

New techniques developed by U. S. Gasket and Metalweld make it possible to cement the Teflon to many surfaces.

Schier voted ASME secretary

Secretary-elect of the American Society of Mechanical Engineers is Oscar B. Schier, II. He succeeds Clarence E. Davies, who retires after 23 years in the office. The post is the chief administrative office of the 50,000-member society.



Welding invades nuclear field

Shown being held before the loading face of the Brookhaven reactor, the new nuclear fuel element is bent into a complex "V" shape and welded at its ends to aluminum rings.

Each plate is about two ft long, three in. wide and 1/16-in. thick. Actually metallurgical "sandwiches," each plate has 93% enriched uranium-aluminum alloy as the "meat," and is completely enclosed in aluminum.

Sylvania-Corning Nuclear Corp. recently signed a contract for 5,000 of the elements for Brookhaven Laboratory in Upton, N. Y. It is the largest number of atomic elements ever ordered on the commercial market for a non-military purpose.

A nuclear reactor is an atomic furnace in which the fuel elements cause a chain reaction. Neutrons (basic atomic particles) and heat energy is produced.

Stulz-Sickles expands; doubles capacity

Stulz-Sickles Co., maker of hard-facing materials, has acquired new, expanded quarters one block east of U.S. Highway 1 in Elizabeth, N.J.

About twice as much office space is available, all on one floor. Other features of the new plant include an eight-inch blacktop warehouse floor which is easily repaired and has "give."

New ovens, mixers and an added production line have been installed for electrode coating. A new fork lift truck is available for palletized shipments, and overhead crane facilities have been added.

AWS group tours Hobart

Thirty-three members of the Indiana Section, American Welding Society, recently toured Hobart Bros. welding equipment firm in Troy, Ohio.

E. A. Hobart, firm president, gave a talk on mining operations in Florida. Many of the minerals mined are used in the company's electrode coatings.

The Indiana chapter elected officers for the 1957-58 term: Edman Holt, chairman; Doug Fitting, first vice-chairman; Robert Hilbert, second vice-chairman; Fred Watts, treasurer; and Mercedes Spotts, secretary.

Sittig to be symposium chairman

Marshall Sittig, president and managing director of American Lithium Institute, Inc., has been selected chairman of a symposium on alkali metals at the American Chemical Society's national meeting. The conclave will be in April, 1958, at San Francisco.

Tube Reducing Corp. gets Niphos process

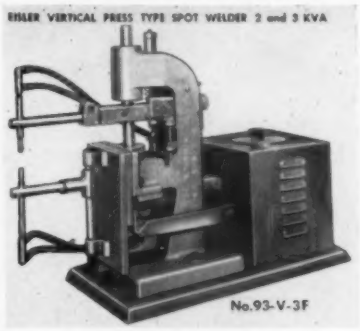
Sole manufacturer of the newly-developed Niphos process will be Tube Reducing Corp., that firm has announced.

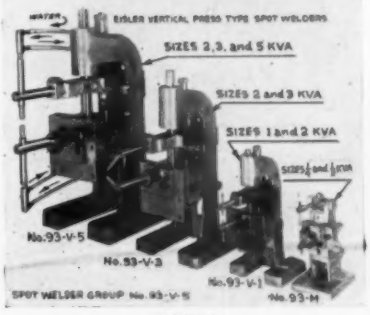
The process is a low-cost method of applying nickel alloy to mild steel to prevent corrosion and give many characteristics of stainless steel to ordinary mild steel. The process was developed by the New York Testing Laboratories.

EISLER VERTICAL TYPE PRESS WELDERS

We also make a complete line of Spot and Wire Butt Welders.

Write for Cat. No. 93-57





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Charles Eisler Jr., President

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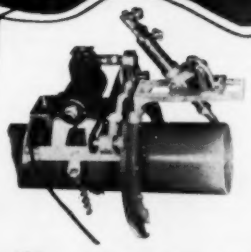
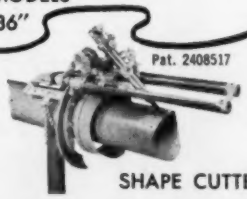
a puzzle with a missing piece

is like . . . Pipe Cutting or Beveling without an H & M





The simplicity of operation, and rugged, but lightweight construction of H & M Pipe Cutting and Beveling Machines, account for the speed and accuracy that is quickly attained, even by inexperienced operators.

The H & M line of machines and attachments is complete in every detail. 7 models of H & M machines are specifically designed to fit a range of pipe from 1½" to 36". Economical and efficient H & M attachments include: Shape Cutter, NEW Out-of-Round, Motorized Unit and Flexible Shaft.

For the full story on the complete line, write H & M . . . today!

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PIPE BEVELING MACHINE COMPANY

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BUILT BETTER
FOR SAFETY
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M1250

DOCKSON
Helmets and
Handshields

Complete protection against sparks, flash and dangerous rays of arc welding. Federal specification plates. Light-weight, roomy, adjustable, comfortable headgear, spring pivot for positive holding, easy raising and lowering. One-piece, rivet-less formed fibre, built to last.

Write for distributor's name and our catalog of Head and Eye Safety Equipment.

M1225

1275

1475

1650

Dockson
CORPORATION
3839 WABASH • DETROIT 8, MICH.

Whitehead celebrates with fabrication forum

To celebrate the opening of the company's new Windsor, Conn., warehouse, Whitehead Metal Products Co., Inc., sponsored a fabrication forum June 4, 5 and 6.

New England metal fabricators saw demonstrations and heard talks on machining, anodizing, bending, flame cutting, welding, brazing, etc. Latest developments in aluminum, copper alloys, nickel alloys, stainless steels and plastics were displayed.

The new 34,100 sq ft. office and warehouse is located on the Hartford-Springfield Expressway in new Windsor Industrial Park. It will carry the full Whitehead line of corrosion-resistant metals and accessories.

Airco advances in research

A new laboratory devoted to developing polymers for paints, adhesives, plastics and coatings is being built by Air Reduction Co. The modern, two-story laboratory will be an addition to Airco's Murray Hill, N.J., research plant.

Ground-breaking ceremonies took place June 19; the new laboratory will be completed by the end of 1957, the firm reports.

New director of metallurgical research at the central research laboratory is Dr. Shadburn Marshall.

Kaiser goes for gondolas

Twenty-four more railroad gondola cars with all-welded aluminum bodies have been ordered by Kaiser Aluminum & Chemical Corp. The firm already has 35 cars operating in their bauxite mining operations in Jamaica.

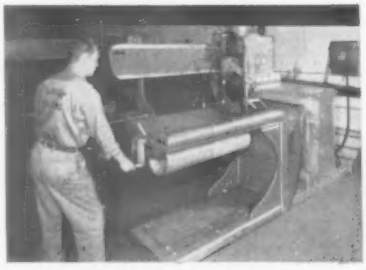
Body metal for the cars is high strength weldable alloy 5086. Their greater payload (84 tons) has increased ore handling operations 20% per car.

Landis named ASME president

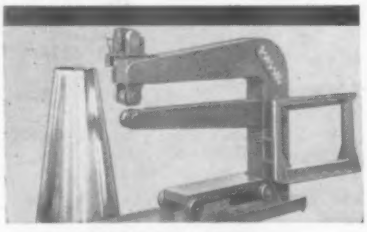
A San Francisco engineering executive, James N. Landis, has been nominated president of the American Society of Mechanical Engineers. He will be installed after a letter ballot of the membership.

how to make fusion butt welding a *push-button operation*

CIRCUMFERENTIAL
automatic welding fixture
Designed for circular welding of components with automatic chucking and ejection of parts and transfer. Chuck expands internally for sizing. Surface speed to 300″ per min.



LONGITUDINAL *automatic fusion butt welding fixture*
Hold-down fingers with "toe touch" control lock parts in position for welding. Back-up mandrell with up to 6 copper inserts permits fast job changes. Handles all weldable metals .005 to 1″ thick and lengths from 2′ to 12′.



ROLL PLANISHING FIXTURE
Cold-rolls and smoothes fusion welds (circ. & longit.) under controlled pressure up to 10 tons. Handles 1¼″ to 10′ dia. and lengths to 16′.

Write today for further information
785 No. Prairie Ave., Hawthorne 2, Calif.

Airline WELDING
WELDING & ENGINEERING
FIXTURES & POSITIONERS
"guides the arc to the mark"

Titanium alloy used in pressure vessels

Titanium is being used in spherical, high-strength pressure vessels for aircraft, missiles and industry.

Vessels are used to store such gases as oxygen, helium and carbon dioxide. Titanium's strength and light weight are desirable in making "bottles" to carry gases in aircraft. Ranging in diameter from 12-in. to 25-in., vessels are formed by hot spinning the hemispheres and using advanced welding techniques to join them.

Titanium Fabricators Inc., Burbank, Calif., manufactures the vessels.

Norelco offices in new sites

Spring was moving time for Norelco sales offices in Chicago and Houston.

The new Chicago address is 5535 Montrose Ave., J. C. Washburn is manager and R. L. Smick is sales engineer.

In Houston, the new office is at 3230 Mercer St. Robert Seibert is in charge.

Monsanto Chemical ups production

St. Louis' Monsanto Chemical Co. has doubled its production capacity for bisphenol A, a resin intermediate used in the manufacture of epoxy and oil-soluble phenolic resins.

Expoxy resins are used in structural laminates and in high-strength adhesives, especially for metal-to-metal bonding. Taking the place of metal rivets, epoxy resin adhesives are used in bonding the aluminum skin on certain sections of modern jet aircraft such as the Boeing 707 jet transport.

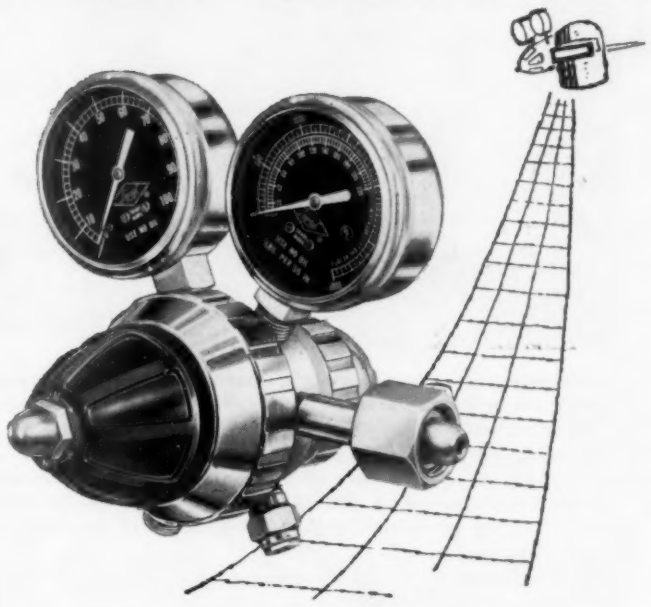
Airco to expand Ohio plant

Air Reduction Sales Co. plans a $3 million expansion to double production facilities for gaseous and liquid oxygen at the Lorain, Ohio, plant.

Plant space will be upped from 985,000 cu ft to 2,235,000 cu ft. An increase in local oxygen consumption made it necessary to expand. Construction was reportedly scheduled for a July start, and the plant should be completed in a year.

The building is part of Airco's $24 million general expansion program for 1957.

A NEW DIMENSION



in gas welding equipment

new All parts are machined from solid bar stock

new Diaphragms are made of special stainless steel

new Safeties are spring-loaded, self-reseating

new *Regulite* adjusting cap—rugged—gives accurate finger-tip control

new Nylon-pointed adjusting screw eliminates metallic friction

new Stabilized seats prevent freezing, vibration and seat ignition

New LIQUIDWELD line of gas welding equipment is not a warmed over design. It presents entirely new concepts in welding engineering . . . design in action, shock-proof performance, friction-free adjustment and new accuracy to meet modern requirements.

The new LIQUIDWELD Regulator shown here is a two-stage type. These regulators provide maximum flame stability through uniformly controlled delivery. Their simplified design minimizes maintenance — they have been tested and approved for greatest operating safety.

New LIQUIDWELD Regulators virtually obsolete your present equipment. They feature *Regulite* adjusting cap that gives finger-tip control . . . easy-reading gauges have colored faces with white calibrations . . . brass finish. In addition to regulators, both single and two-stage, the LIQUIDWELD line includes complete selection of torches and tips . . . expressly designed to be functional!

Write for complete particulars. LIQUIDWELD and GASWELD are divisions of The Liquid Carbonic Corporation, makers of famous Red Diamond Welding Grade Gases.

Liquidweld

THE LIQUID CARBONIC CORPORATION

3100 South Kedzie Avenue • Chicago 23, Illinois

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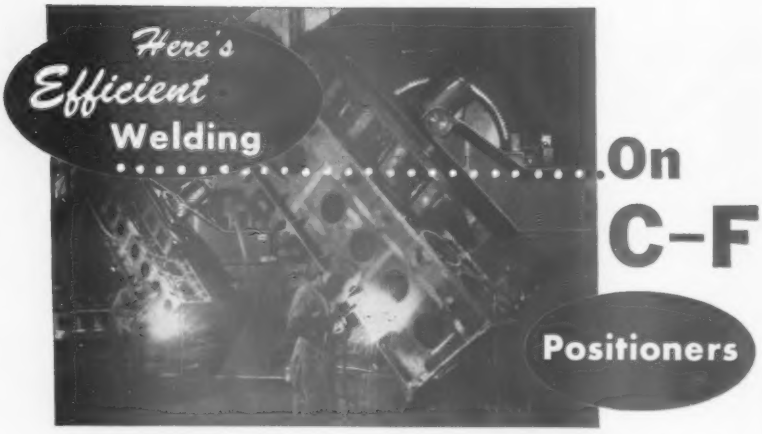

When heavy, unwieldy weldments like these diesel crankcases can be quickly swung into any position so that every weld is made *downhand* —that's efficient welding!

Welders spend more time welding—do better welding at lower cost when they work with C-F Positioners because these hand and/or power operated machines reduce positioning time to a minimum. Investigate the cost-saving advantages of C-F Positioners. They pay their way in any company.

Write for Bulletin WP26—an illustrated circular detailing the Specific advantages of C-F Positioners.

CULLEN-FRIESTEDT CO.
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CULLEN-FRIESTEDT CO., CHICAGO 23, ILL.

C-F positioned welds mean better, more economical welds

SAVE TIME AND MONEY!

A SMOOTH SWING of the Contour Marker's soapstone point and you're ready to cut! It's easy and *absolutely accurate* because there is an angle dial calibrated in both degrees and pitch. Any of the pipe joint angles shown can be marked off in minutes. And you save "man hours" as well as oxygen and acetylene gas because "cut and try" methods are completely eliminated. Two sizes are available complete with adapter for marking structural steel. Standard, for pipes from 1½" to 18" dia.; Jumbo, for pipes from 16" to 48" dia. Instruction book included. Belt case available. Write for information

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THE CONTOUR MARKER

COMING EVENTS

SEPT. 12-13: NWSA Central Zone Meeting, Sheraton-Gibson Hotel, Cincinnati.

SEPT. 16-17: NWSA Eastern Zone Meeting, Commodore Hotel, New York City.

OCT. 7-9: National Electronics Conference, co-sponsor Illinois Institute of Technology, Hotel Sherman, Chicago.

OCT. 21-25: National Safety Congress, Chicago.

OCT. 27-NOV. 1: Fourth Annual conference, Atomic Industrial Forum, Second Fall meeting, American Nuclear Society, and Trade Fair of Atomic Industry, Coliseum, New York City.

NOV. 4-8: Thirty-ninth National Metal Exposition & Congress, concurrently with Second World Metallurgical Congress, American Society for Metals, International Amphitheatre, Chicago.

NOV. 11-12: NWSA West Central Zone, The Cosmopolitan, Denver.

NOV. 14-15: NWSA Western Zone Meeting, Riviera Hotel, Las Vegas.

DEC. 2-3: NWSA Southeastern Zone Meeting, Atlanta Biltmore, Atlanta.

DEC. 5-6: NWSA Southwestern Zone Meeting, The St. Anthony, San Antonio.

NYU to hold titanium lectures

The third annual titanium lecture program will be held Sept. 9-13 by New York University's College of Engineering on University Heights Campus, New York City. American and foreign authorities will speak.

Lithium Institute gets new home

The American Lithium Institute, Inc. has moved to new and larger quarters on the fourth floor of 32 Nassau St., Princeton, N. J.

A non-profit organization, the Institute was founded to broaden the present markets for lithium and its compounds and develop new markets through research. Lithium is used in making brazing alloys.

Mail for the Institute should be addressed to Box 549, Princeton, N. J.

Distributor appointments

Nelson Stud Welding Div., Gregory Industries, Inc., Lorain, Ohio: Darbyshire Steel Co., El Paso, Texas; William P. Somerville and Co., Vancouver, British Columbia, Canada.

Fred L. Plummer is the newly appointed secretary of the American Welding Society. The appointment was first announced in the July issue of *Welding Engineer*. He succeeds *Joseph G. Magrath*. Plummer's office will be at the Society's New York headquarters. He has been director of engineering at Hammond Iron Works, Warren, Pa., since 1940. Before that, Plummer was a professor at Case Institute of Technology and a consulting engineer. He is a past president of AWS.

R. E. Lenhard has become executive vice-president of Air Reduction Sales Co. He was president of the Ohio Chemical & Surgical Equipment Co., a division of Air Reduction Co. *W. A. Lunger*, vice president of the Ohio division, succeeds Lenhard.

Frank B. Falvey has been appointed sales representative in New York for the American Manganese Steel Div. of American Brake Shoe Co.

The Budd Co., producers of gamma radiography equipment for non-destructive testing, made these additions to its staff: *Aaron V. Kelley*, sales manager of the west coast district; *Martin L. Dion*, sales manager of the southwestern district; *Dr. William E. Parker*, manager of product research in Philadelphia.

Owen L. (Duke) Howland retired June 30 as a special representative of Metal & Thermit Corp. He joined the firm in 1943, after serving in Washington with the War Production Board. He had been with Hollup Corp., a division of National Cylinder Gas, and The Lincoln Electric Co.

Progressive Welder Sales Co., Detroit, has named *H. S. Rose* as sales manager; *W. B. Payne*, assistant sales manager; *Ray Heiden*, general manager.

Alloys and Fluxes for joining ALL METALS by ALL METHODS
TORCH WELDING
SOLDERING · FILLING · SEALING
TORCH BRAZING
FURNACE BRAZING
ARC WELDING
ADVANCED
"Jet Flux" System
auto dispenser and brazing liquid
ALL-STATE
Silver Brazing
alloy dispenser for Mr. Fix-It
STAINLESS
Solder Kit
for 10,000 to 28,000 psi T
Melds smoothly into brazing operations. Permits elimination of paste flux. Ruggedly compact, sized for work-week without refilling. Attach to fuel line on truck or station . . .
see your DISTRIBUTOR for demonstration
Includes wire and flux. The only good way to keep silver solder safe and ready for maintenance and service men. Six choices from 3 kinds, 2 lengths. Save time and money.
buy from DISTRIBUTOR he keeps stocks
All-State's greatest Solder. Useable on stainless, monel, brass, bronze, steel, copper. Contains 6 ft. No. 430 Silver-Bearing Stainless Solder and supply of flux. 1 job saves cost.
buy by the doz. from DISTRIBUTOR local stock
All-State Welding Alloys Co., Inc. White Plains, N. Y.
ALL-STATE ALLOYS AND FLUXES
REQUEST COMPLETE LIST OF THESE PRODUCTS FOR PROBLEM SOLUTIONS

Illustrating Ruemelin Fume Collectors in action. Part of a group of sixteen collectors at plant of Sterling Wheelbarrow Co., Milwaukee.

Collects fumes at the source! Counterbalanced inlet hood stays in working area automatically. Hoods have great lateral and vertical range for table, positioner or floor use. Thousands in every day service. Write for bulletin 37-E.

RUEMELIN MFG. CO.

MFRS. & ENGRS. • SAND BLAST & DUST COLLECTING EQUIPMENT
3880 NORTH PALMER STREET • MILWAUKEE 12, WISCONSIN, U. S. A.

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for all types and makes of welding equipment

Everything you need from *one* source, with *one* responsibility. The fast, economical way to order. Catalog gives complete specifications, factory numbers, scaled drawings, etc. Write for your free copy today.

WHOLESALERS:
Some Distributorships still open.
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3450 SO. LARAMIE AVE • CICERO 50, ILLINOIS

X-RAY UNIT YOU, TOO, CAN AFFORD TO "WEAR"

Complete Baltospot X-ray unit—X-ray head, cables and control panel—costs less than $3000. Head weighs only 47 pounds, yet has rating of 140,000 volts and penetration up to 1½" of steel. Applicable to most X-ray inspection jobs, the Baltospot is the most powerful unit for its weight available. Dust-sealed, shock-proofed, moisture-proofed. USE PROVEN. Write for details.

OTHER UNITS rated 120, 160, 180, 200 and 260 KV for portable or stationary inspection of material from thin aluminum to 4" of steel. BG 180 for 360° radiography.

BALTEAU ELECTRIC CORPORATION
New and Meadow Streets, Stamford, Connecticut
Manufacturers of DIFFERENT X-Ray Equipment for Industry and Medicine

Recent personnel changes in the welding division of Metal & Thermit Corp. are: *N. F. Kierman* to post of regional manager in west central region with offices in East Chicago, Ind.; *J. DeSanto,* acting regional manager for East Chicago for past two years, is assigned additional sales duties in Chicago area; *C. F. Delbridge* succeeds Mr. Kierman as northeastern regional manager and will have offices at Rahway, N. J.

PLANT manager for Sylvania is Kenneth F. Middaugh. He is in charge of weld operations.

Newly-appointed plant manager in charge of weld operations for Sylvania Electric Products Inc. is *Kenneth F. Middaugh.* He will be responsible for manufacturing operations at Sylvania's weld plants in Warren, Pa., and in Nelsonville, Ohio.

Don Walsh has been named Belden Mfg. Co.'s sales service manager of the merchandise sales division in Chicago. Other midwestern appointments are: *Ralph Glende,* covering Illinois and Missouri; *Ken Williams,* assigned to Des Moines to cover Iowa and eastern Nebraska; *Warren Howe,* market analyst in Chicago; *Art Anderson,* covering eastern Michigan and northwestern Ohio; *Bill Brierton,* taking over a newly formed industrial territory in northern Ohio.

Belden appointees in Texas are: *Bill Donahoe,* assigned to Houston to cover south Texas, and *Bob Willwerth,* headquartering in Dallas to concentrate on north Texas and Oklahoma.

A. O. Smith Welding Corp., Milwaukee, has increased the number of its sales districts. Sales personnel in the newly created Chicago and Detroit district now report to *W. P. Finneran* and *A. M. Brinson,* former sales representatives in those cities.

Elected to fill Tracerlab, Inc.'s new position of vice-president for marketing is *Homer S. Myers.* He was one of the founders of the Waltham, Mass., firm, and has been general manager of its Industrial Division. Other appointments are: *Robert J. Allen,* assistant advertising manager; *Joseph P. Beyer,* sales representative in Los Angeles; *Charles B. Mead,* sales representative in Detroit.

Eutectic Welding Alloys Corp. announces two new appointments: *John E. Jackson*, regional manager and *M. A. Haberman*, manager of the Canadian plant office in Montreal. Jackson will train and coordinate the activities of a group of Eutectic district engineers. Haberman will supervise customer service and conduct Eutectic Welding Institute courses in the plant. Both men had been stationed at the firm's headquarters in Flushing, N. Y.

George Konkol was appointed to the new position of manufacturing manager in charge of wire, weld and metal stamping for Sylvania Electric Products, Inc. He will be responsible for manufacturing operations at Sylvania's weld plants in Warren, Pa., Nelsonville, Ohio, metal stamping plant in York, Pa., and wire plant in Warren.

G-E power tube sales force has ten new members: *Herbert W. Cole*, *William R. Rate*, Clifton, N. J.; *Robert L. Hanna*, *H. W. A. Chalberg*, Chicago; *A. Holland Phillips*, Los Angeles; *C. W. Hamaker*, *W. F. McKeehan*, *D. F. Herdeg*, *K. E. Wilson* and *W. G. Granat*, at headquarters in Schenectady, N. Y.

H. Robert Hanson has been appointed Southeast regional manager by the K-G Equipment Co. His headquarters are in Clearwater, Fla., where he services welding supply distributors in Florida, Georgia and Alabama.

J. J. Wycall has been chosen manager of Crucible Steel Co.'s St. Louis branch. He succeeds *K. C. Kelly*, who will fill a newly created position of southern regional sales manager. *R. D. Leslie* succeeds Wycall as assistant St. Louis branch manager.

R. D. Rowley has been named manager of the Westinghouse metals plant at Blairsville, Pa. He succeeds *Warren M. Trigg*, who is new manager of the company's motor department at the motor and control division, Buffalo, N. Y. Rowley announced the appointment of *E. C. Bishop*, manager of alloy products, and *J. Q. A. McClure*, manager of fuel products.

Samuel R. Parry has been elected vice president of Combustion Engineering, Inc., manufacturers of steam generating and nuclear equipment. He will continue as general manager of the Chattanooga division, the firm's largest manufacturing operation.

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John R. Onders and *Charles S. Ghastin* have been chosen sales engineers for Wall Colomonoy Corp., Onders in the Pittsburgh office and Ghastin in the New York branch.

To handle demands for Shieldalloy products, *Thomas H. LeCompte* has been appointed sales specialist. He will direct sales of special alloys for tool and stainless steels, chromium metals and titanium.

R. E. Cornwell has been appointed president of Union Carbide Development Co. For the past 20 years he has been working on the development of various welding processes. Cornwell has been vice-president of Linde Co. and Union Carbide Development.

SELECTED as manager of Resisto-Loy's western division, Kenneth Lutz directs sales and service.

Kenneth V. Lutz has been chosen manager of Resisto-Loy Co., Inc.'s western division. He will direct sales and service in the western states, western Canada, Alaska and Hawaii. Lutz was formerly vice president in charge of sales for All-State Welding Alloys Co.

At a June meeting of the board of directors of the American Welding Society, *C. B. Smith* was appointed chairman of the national AWS membership committee. He is employed by Douglas Aircraft, Inc., Long Beach, Calif.

Formerly welding research engineer in charge of the industrial engineering department, *Gordon Cape* has been named manager of technical research for Canada's Dominion Bridge Co. *Llewellyn Jehu* succeeds Cape.

Crucible Steel Co. has elected *George W. Stamm* vice president of sales and *C. J. Ryan* fills a new position, assistant to Stamm. Ryan will headquarter in Detroit to bring executive sales closer to Detroit specialty customers. Stamm succeeds *James D. Glenn*, who was forced to resign because of ill health. He will remain with the firm as a consultant.

Robert M. Briney has been selected president of Haynes Stellite Co., a division of Union Carbide Corp.

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IMPROVE WELDING QUALITY WITH THE TONG TEST

AC-DC AMMETER

Now you can measure actual AC or DC welding currents without losing valuable production time. The Columbia TONG TEST is simply clamped around the electrode cable. Instantly you get an accurate ampere reading to control and maintain welding quality. Interchangeable ranges available up to 1000 amperes.

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I. E. Boberg, chief engineer of Chicago Bridge & Iron Co., Chicago, has been elected a vice president and *Leo J. Marcoux*, controller, has been elected secretary. Boberg is an AWS member.

Hugh O. Weatherford has been named sales manager for United Specialties, Inc. He has served as factory representative since Jan. 1, 1956, with headquarters at the factory in El Dorado, Ark.

New district manager of Sight Feed Generator Co., W. Alexandria, Ohio, is *A. A. (Gus) Osborne*. He will serve northeastern United States.

David A. Elliott has been appointed sales manager of the midwestern area for Nuclear Systems, a division of the Budd Co.

Jack A. Scarlett has been elected vice president of manufacturing of United Welders, Inc., Bay City, Michigan.

Edward W. Lothman was elected a director of Whitehead Metal Products Co.; *Richard W. Nuffort*, secretary; *Frank A. Fink*, treasurer and *John W. Bonnet*, administrative assistant to the president and assistant secretary.

Paul L. Lantz has been named production manager of the Abrasive Division of Norton Co. He succeeds the late *George A. Fryberg* who died April 6. Lantz has been assistant manager of the industrial engineering department since the fall of 1956.

The Chicago district office of Air Reduction Sales Co. has been expanded to include the Bettendorf, Iowa, area. *Fred G. Meyer*, assistant sales manager, has been named branch manager at Bettendorf.

William B. Downs has been named manager of stainless steel sales division, Crucible Steel Co. of America. He will headquarter in Pittsburgh.

Died . . .

Arthur J. Fausek, 71, board chairman and co-founder of Modern Engineering Co., St. Louis, died June 20, after suffering a stroke. He had been only partially active since an earlier stroke several years ago.

With his brother, Irving F., Mr. Fausek founded the Meco firm in 1911. He was a past president of the International Acetylene Association and a recipient of that organization's highest award, the Morehead Medal. Mr. Fausek is survived by his widow, four brothers and two sisters.

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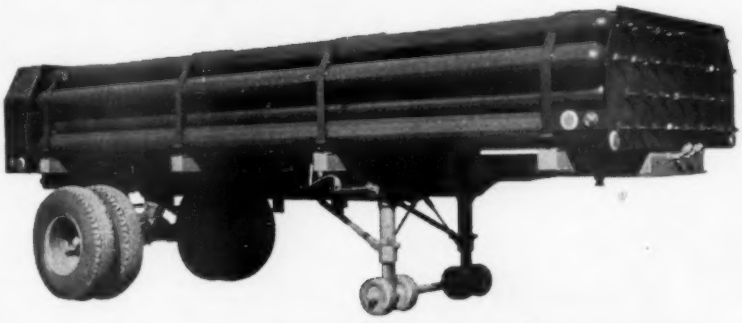

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30 YEARS AGO

(Taken from *The Welding Engineer* of August, 1927)

Burt Bowelle's plane was traveling at its minimum speed of 35 mph when he was forced into a boulder-strewn canyon in North Dakota's Badlands. The wings were badly broken and the canvas-covered fuselage torn. Passengers in the wrecked plane were undoubtedly saved by the strength of the oxy-acetylene welded joints.

—30 YEARS AGO—

A new patented vaporizing hand pump kerosene burner, particularly adapted for use in welding, is a new product of H. H. Kress of Philadelphia.

—30 YEARS AGO—

By fitting the base of the electric welder to the rear end of an old discarded Republic truck, Tampa Electric Railway fashioned its own portable welder.

—30 YEARS AGO—

Air Reduction Co., Inc. purchased the oxygen and acetylene business of United Gas Improvement Contracting Co., Philadelphia. The company now operates 34 oxygen and 19 acetylene plants.

—30 YEARS AGO—

Una Welding and Bonding Co.'s new electrode is intended for building up dipper lips, frogs, switches, crossovers, wobblers, shovel points and rock crusher jaws.

—30 YEARS AGO—

Approximately 2½ million gallons of gasoline can be city-stored in 24 welded rectangular pressure tanks. With gasoline and fuel oil consumption increasing at a rapid rate, storage has become a problem.

—30 YEARS AGO—

Denver offers an "Opportunity School" where men can learn welding. The school turns out instructors for schools, universities and colleges.

—30 YEARS AGO—

There seems to be no hope for obtaining specifications for welding wire, an editorial moans. It suggests establishing an impartial bureau to examine welding wire and welding equipment.

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SUPAIRCO plants produce gaseous or liquid oxygen, gaseous or liquid nitrogen, acetylene, liquid air

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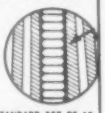

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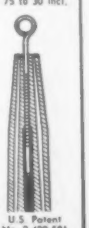

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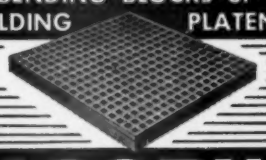

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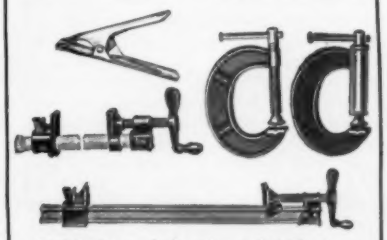

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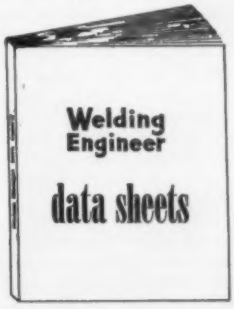

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51. TORCH FILTER—Gibbs Ltd. Illustrated sheet fully describes no flash torch filter with "Permetal" bronze elements. Connects between hose and torch in less than one minute. Cleans, prevents flashbacks.

52. WELDING HEADS—Pandjiris Weldment Co. Catalog 8155 gives information and specifications on welding head manipulators, turning rolls, positioners and special fixtures for automatic welding.

53. HARDFACING — Eutectic Welding Alloys Corp. Technical and application data on Dril-Tec 86, 88 and 89, hardfacing alloys, are available.

54. COVER PLATE — American Optical Co. Brochure S-6310 describes aluminized plastic cover plate for welding helmets and aluminized cellulose acetate face shield window for protection against radiant heat.

55. POWDER BLOWER — Magnaflux Corp. Information on self-contained portable powder blower No. 58600.

56. SAFETY HAT — Jackson Products. Bulletin form 41 details all plastic safety hat for electrical and construction workers.

57. VALVE—Ross Operating Valve Co. New silver model valve designed to comply with JIC standards is treated in literature.

58. ALLOY—Eutectic Welding Alloys Corp. Eutec-Rod 999FC, a torch alloy to join poor fitting aluminum, is discussed in leaflet.

59. TEMPLATES—A. Lawrence Karp. 1957-1958 catalog of 100 industry-approved templates for all specializations is provided.

60. DUCT HANGER—Square D Co. Complete details furnished on two-piece lay-in duct hanger with 20 different ways to install.

61. CUTTING OUTFIT—Linde Co. Literature treats improved model of Prest-O-Lite No. 420 welding and cutting outfit capable of welding up to ⅜-in. and cutting up to 2-in. Outfit includes four interchangeable tips, 12½ ft. length twin hose goggles, friction lighter, wrench.

62. MAINTENANCE STEELS — Joseph T. Ryerson & Son, Inc. Folder details maintenance steels and allied products. Includes carbon steel shafting, leaded alloy bars, galvanized sheets, flame cutting.

63. RESEARCH—General Electric Co. Reprint of article "Can scientists be prophets?" from G. E. Review, May, 1957.

64. RECTIFIERS—International Rectifier Corp. Volume 2, No. 1 of news sheet discusses tube base mounted silicon rectifiers as replacements for certain vacuum tube rectifiers.

65. SPARK LIGHTERS — Lummis Mfg. Co. Page on "Key-bak," watch size case with steel chain to hold spark lighters. Steel chain retrieves lighters.

66. GAS REGULATOR—K-G Equipment Co., Inc. Literature on small, moderately-priced gas flow regulator called "K-G Jeep".

67. ELECTRICAL EQUIPMENT—Sittler Corp. Colorful 20-page catalog No. 57 covers products and equipment including wire and cable, portable spot welders and wire strippers, voltage testers and commutator maintenance equipment.

68. TUMBLASTS — Wheelabrator Corp. Descriptive bulletins on four continuous tumblasts, airless abrasive blast cleaning machines. Bulletin 136-D on 15 in. model, 131-D on 36 in., 133-D on 48 in. and 110-D on 60 in.

69. LUBRICANTS—Van Straaten Chemical Co. New 12-page brochure on how to select tool lubricants and grinding coolants.

70. WALL CHARTS——Eutectic Welding Alloys Corp. Two-color wall charts designed for technical schools and plant training programs in practical aspects of torch and arc welding. Illustrate correct arc and torch welding procedures.

71. CERAMIC—Duramic Products Div., Technion Design & Mfg. Co., Inc. Bulletin 110 explains new ceramic now being applied to shielded arc welding nozzles, induction heating jigs, brazing plates, welding back-up jigs, supports. Resistance to rapid changes in temperature.

72. ELECTRODES—Ampco Metal, Inc. Second quarter 1957 issue of news cites savings resulting from use of bronze electrodes and filler rod.

73. WELDING TECHNIQUES — Eutectic Welding Alloys Corp. 28-page special automotive issue of Technical Information Digest gives special welding techniques, procedures for metals.

74. STEEL COSTS—Wheelabrator Corp. 8-page booklet on mechanical descaling of steel points out how plants that require cleaned hot-rolled steel can save in steel costs.

75. ELECTRONIC FLUOROSCOPY — Philips Electronics, Inc. Modern techniques for applying electronic fluoroscopy in metal examinations are detailed in 6-page folder.

76. POLYMERS—General Electric Research Laboratory. Polymers, crystals and plasmas is subject of address by Dr. Guy Suits, reprinted in attractive book.

77. CORROSION PROBLEMS — Babcock & Wilcox Co. Publication ASL 288 provides data on Croloy 18-8. Attacks problems of corrosion and high temperature service.

78. ALLOY—Hoskins Mfg. Co. Catalog-manual M-55D covers nickel-chromium-iron heating element alloy recommended for use in controlled atmosphere furnaces.

79. INSTRUMENT—Newage Industries, Inc. Folder illustrates 30-ounce instrument used to test hardness of any metal. Gives hardness ranges.

80. PLUNGER RELAYS—Ebert Electronics Corp. Engineers' fact file 157 on mercury plunger relays and related products includes load ratings.

81. HOSE CLAMPS—Ideal Corp. Literature on line of hose clamps for automotive, aviation and plastic pipe fields.

82. HOSE FITTINGS—Service Mfg. & Supply Co. Folder offers data on brass air and water hose fittings and accessories.

83. POSITIONERS—Aronson Machine Co. Brochure No. FT57 on floor turntable welding positioners ranging in capacities from 1,000 to 120,000 lbs.

84. WELDER—Lincoln Electric Co. Folder presents Idealarc 300, 400 and 500 amp combination a-c and d-c welder. Specifications and construction details.

85. BRONZE ROD—Aufhauser Bros., Corp. Illustrated sheet on bronze welding rod No. 1 for gas welding.

86. WELDING—Hobart Bros. Co. Vol. XIV, No. 2, Hobart Arc Welding News gives photos and articles on welding, time and money saving applications.

87. X-RAY INSPECTION—Philips Electronics, Inc. Bulletin reprints article describing use of X-ray for inspection of airplanes.

88. WELDING WIRE—Reid-Avery Co., Inc. Bulletin AW 100 treats automatic welding wire for submerged arc and inert gas welding; bulletin AH 200, equipment for automatic welding; bulletin 151, low hydrogen iron powder electrodes and data sheet presents advantages of Race 6011 iron powder electrodes.

89. WELDING DATA—American Chain & Cable Co., Inc. Bulletin DH-1218-K details physical properties as welded, gives Rockwell hardness and lists typical uses of gas welding rods, bare electrodes, automatic welding wire and metal spray wire.

90. TORCH FILTER—Tippett and Co., Inc. Literature on design torch filter for liquid or gaseous fuels used with welding, brazing or cutting torches.

91. ALUMINUM—Whitehead Metal Products Co., Inc. Clever folder gives data on aluminum.

92. TITANIUM — Mallory-Sharon Corp. 20-page fact file booklet is reference for design, material and production engineers.

93. CUTTING MACHINE—Wallace Supplies Mfg. Co. 44-page catalog on firm's cut-machining units provides set of four cut-machined samples.

94. CUT-OFF WHEELS—Bay State Abrasive Products Co. Folder describes wheel types, includes specifications on reinforced and non-reinforced.

95. HEATER—Silent Glow Oil Burner Corp. Colored sheet details portable radiant personnel heater, Model PR. Gives typical uses, specifications.

96. WELDING MATERIALS—Aluminum Co. of America. Welding, brazing and soldering materials are outlined in leaflet. Recommendations for using materials offered.

97. ELECTRODE — International Nickel Co., Inc. For corrosion-resistant welds between dissimilar alloys, booklet sells Inco-Rod "A" electrode.

98. TUBING—Superior Tube Co. Bulletin 40 is a guide to the selection and application of firm's tubing. Includes stainless steel, nickel, glass sealing alloys, beryllium copper, titanium, carbon and alloy steels.

99. METALS—Rigidized Metals Corp. "Imagination rolled into metal" is folder describing fabricating methods, metal patterns and finishes available and picturing patterns.

100. HEATER—Silent Glow Oil Burner Corp. Sheet details automatic portable indirect fired heater, Model ID. Typical uses and specifications listed.

101. WIRE MESH—C. O. Jelliff Mfg. Corp. Booklet describes special alloys and metals used in wire mesh, lists weaves and uses.

102. ELECTRODES—International Nickel Co., Inc. Catalog is guide to welding cast irons with "Ni-rod and Ni-rod 55" electrodes. Offers tips on preparation, emergency repairs, getting maximum machinability, production welding, welding heavy sections.

103. NICKEL TUBING—Superior Tube Co. Attractive catalog 12 describes mechanical and chemical properties of tubing, selection and application, etc.

104. RESINOID PRODUCTS—Bay State Abrasive Products Co. Index of types of wheels. Includes raised hub disc, cut-off, reinforced resinoid straight.

105. METAL ALLOYS—H. K. Porter Co., Inc. Technical bulletin T-4 on "Flexograin," fine grain phosphor bronze which offers fabrication and service advantages.

106. DETECTOR — Tracerlab, Inc. Ten versions of new scintillation detector detailed in bulletin 86. Model P-20C extends to field of pulse height analysis.

107. SPEED DRIVE—Graham Transmissions Inc. Variable speed drive covered in bulletin 522. Features all speeds from top to zero, multiplied torque at low speeds.

108. X-RAY—Philips Electronics, Inc. Article reprint gives methods used for automatic X-ray inspection of subminiature electron tubes.

109. RESISTANCE WELDING — Ames Spot Welder Co., Inc. Catalog on special welding press, welders, fixtures.

110. ABRASIVE PRODUCTS—Bay State Abrasive Products Co. NWSA index 1010 contains information on raised hub disc-wheels, abrasive discs and accessories.

111. PROTECTIVE EQUIPMENT—Fibre-Metal Products Co. Literature details such equipment as helmets, electrode holders, weld-prober, rod carriers, hammers, goggles and face shields.

112. SNAGGING WHEELS—Bay State Abrasive Products Co. Folder describes portable snagging wheels, including specifications.

113. CUTTING NOZZLES — Linde Co. Folder presents story of "Oxweld" cutting nozzles. Illustrates manufacture of nozzles.

114. GRINDING WHEELS — Cincinnati Milling Products Div. Booklet details firm's "Positive Duplication" manufacturing process. The 36 page brochure discusses wheel markings, types and uses. Section shows wheel mounting methods, safety and inspection practices.

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125. Adjustable Clamp Co.—Catalog on complete line of "Jorgensen" and "Pony" clamps.

126. Airline Welding & Engineering—Information on how to make fusion butt welding a push-button operation.

127. Air Products, Inc.—Information on ultra high purity Argon from cylinder to tank car quantities at minimum prices.

128. Air Reduction Sales—Write for Catalog 9-13 depicting complete line of welding supplies and accessories.

129. Allied Welder Corp.—Information on standard welders, welding guns and special equipment problems.

130. Alloy Rods Co.—Write for bulletin AR-10, the selector guide to superior quality stainless steel weld metal.

131. All-State Welding Alloys Co., Inc.—Write for name and address of nearest dealer.

132. American Manganese Steel Div.—Write for technical data regarding "Super HF-20" iron powder "contact" electrode.

133. Arcair Company—Write for helpful booklet on how to cut costs over chipping and grinding.

134. Aronson Machine Co.—Write for name and address of nearest dealer.

135. Atlas Welding Accessories—Write for data on complete weld-cleaning tool line.

136. Balteau Electric Corp.—Details on "Baltospot" X-ray unit—X-ray head, cables and control panel.

137. Bay State Abrasive Products Co.—Information about raised hub disc grinding wheels, reinforced for extra safety.

138. Becker Bros. Carbon Co.—Write for catalog giving complete specifications and scaled drawings of carbon welder brushes.

139. Bridgeport Brass Co.—Booklet, "Bronze Welding—Modern Tool of Industry," contains data on "No. 192" low-fuming bronze rod and other alloys.

140. Cam-Lok Div.—Catalog and prices on complete line of welding accessories and supplies.

141. Columbia Electric Mfg. Co.—Write for 8-page catalog WE-400 for line of testing equipment.

142. Contour Marker Corp.—Information and instruction book on laying out pipe joints.

143. Crucible Steel Co. of America—Information on how "Rexweld" helps to increase production, lower downtime and cut manufacturing and maintenance costs.

144. Cullen-Friestedt Co.—Bulletin WP26 details specific advantages of "C-F" positioners.

145. Delta Welder Corp.—Details on how equipment developments and machines can save you time and money in high production resistance welding.

146. Dockson Corp.—Catalog of head and eye safety equipment for complete protection.

147. Drawalloy Corp.—Send for bulletin AR-10, the selector guide to superior quality stainless steel weld metal.

148. Eastman Kodak Co.—Details on how Industrial X-ray, Type "AA", can save time and extend the usefulness of present radiographic equipment.

149. Eisler Engineering Co.—Write for Catalog No. 93-57 for complete line of Spot and Wire Butt Welders.

150. Fibre-Metal Products Co.—Bulletin 55 on new "Superlite" aluminum safety hat and other safety equipment.

151. Foote Mineral Co.—Send for informative brochure, "Raw Materials for Welding Rod Coatings."

152. General Electric Co.—Information on cost-cutting non-synchronous controls for resistance welding.

153. General Electric Co.—Write for name and address of nearest GE X-ray dealer.

154. H & M Pipe Beveling Co.—Full story on how pipe cutting and beveling is made quick and easy.

155. Harnischfeger Corp.—Information on how welding positioners can save time and money.

156. High Voltage Engineering Co.—Write for 24 page Bulletin R for detailed information about supervoltage radiography.

157. Hobart Bros. Co.—Send for complete information on DC rectifier and "Rocket 24" electrodes.

158. Independent Engineering Co., Inc.—Details on how to reduce cylinder handling with gas supply trailers.

159. International Nickel Co., Inc.—Write for "Inco Welding Products" for description of electrodes, wires, rods and fluxes.

160. Jackson Products—Write for information on complete line of welding equipment and accessories.

169. Johns-Manville Corp.—Send for booklet TX-2A for complete line of asbestos products.

161. Krembs & Co.—Write for chart and sample of any of 25 "Fluxines".

162. Lenco, Inc.—Details on heat-resistant, completely insulated "Hi-Amp" electrode holders.

163. Lincoln Electric Co.—Write for Mild Steel Weldirectory SB-1351, giving physical properties of these steels and procedures for welding.

164. Linde Co.—Send for "Modern Methods of Joining Metals" for modern welding metals.

165. Liquid Carbonic Corp.—Details on line of all-new welding equipment.

166. Maitlen & Benson, Inc.—Details on "Wypo" cutting and welding tip cleaners.

167. Mallory & Co., Inc., P. R.—Send for information on titanium development.

168. Merrill Bros.—Information on lifting clamps, twin and drum lifters, drum tilter and other material handling devices.

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USE THIS CARD for Literature, Catalogs, and Bulletins shown on preceding pages and for those featured in this month's ads as listed opposite and on following page

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Every month WELDING ENGINEER lists many new catalogs and bulletins available from manufacturers. All are yours for the asking. However, this service is valuable to you only if you use it.

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ad literature

(Continued from page 92)

170. Metal & Thermit Corp.—Details on "Murex" mild-steel, low-alloy electrodes; "Hardex" new low-hydrogen, hardfacing electrodes; automatic and manual welding machines and accessories.

171. Miller Electric Mfg. Co., Inc.—Information on new "Gold Star SR", including inert gas and automatic fixture welding.

172. National Carbide Co.—Write for name and address of nearest supplier.

173. National Welding Equipment Co.—Send for name and address of nearest dealer.

174. North American Philips Co.—Send for name of nearest dealer and folder, prices and information on tig welding.

175. Norton Co.—Write for details on precisely balanced economy wheels for cutting costs.

176. Page Steel & Wire Div.—Information on solutions to troublesome weldments problems.

177. Picker X-Ray Corp.—Write for name and address of nearest dealer.

178. Pure Carbonic Corp.—Write for information concerning CO_2, the low cost gas shield for metal arc welding.

179. Renfroe & Sons, Inc., J. C.—Write for catalog of complete line of Steel Lifting Clamps.

180. Ruemelin Mfg. Co.—Send for Bulletin 37-E for details on welding fume collectors with counterbalanced inlet hoods.

181. Shawinigan Products Corp.—Write for name and address of nearest dealer.

182. Smith Welding Equipment Corp.—Send for information on "Pipeliner" welding torch and cutting assembly.

183. Stoody Co.—Send for complete information on semi-automatic hardfacing.

184. Stulz-Sickles Co.—Write for complete details on manganese-nickel steel wedge bars.

185. Superior Air Products Co.—Write for catalog on "Supairco" plants and production and storage equipment for various gaseous and liquefied gases.

186. Taylor-Winfield Corp.—Send for details on how a custom-built projection welder can perform versatile assembly work, thereby reducing costs.

187. Tempil Corp.—Information on, and sample of pellets (state temperatures of interest) of temperature indication materials for all heat-dependent operations.

188. Tennessee Fabrication Co.—32-page catalog, "Everything for the Ornamental Iron Shop."

189. Titanium Alloy Mfg. Div.—Send for detailed literature on advantage of "Rutflux" electrode coatings.

190. Tube Turns, Inc.—Send for name and address of nearest dealer.

191. Tweco Products, Inc.—Write for catalog depicting complete line of arc welding accessories.

192. United Wire & Supply Corp.—Send for details on how you can profit from automated brazing with "Phoson 6".

193. Vickers Electric Div.—Ask for complete information on the versatile Control-arc DC Welder.

194. Victor Equipment Co.—Write for the "Hardfacing Manual", which shows the right rod to use and how to apply it.

195. Victor Equipment Co.—Send for descriptive bulletins on new two and three hose machine cutting torches.

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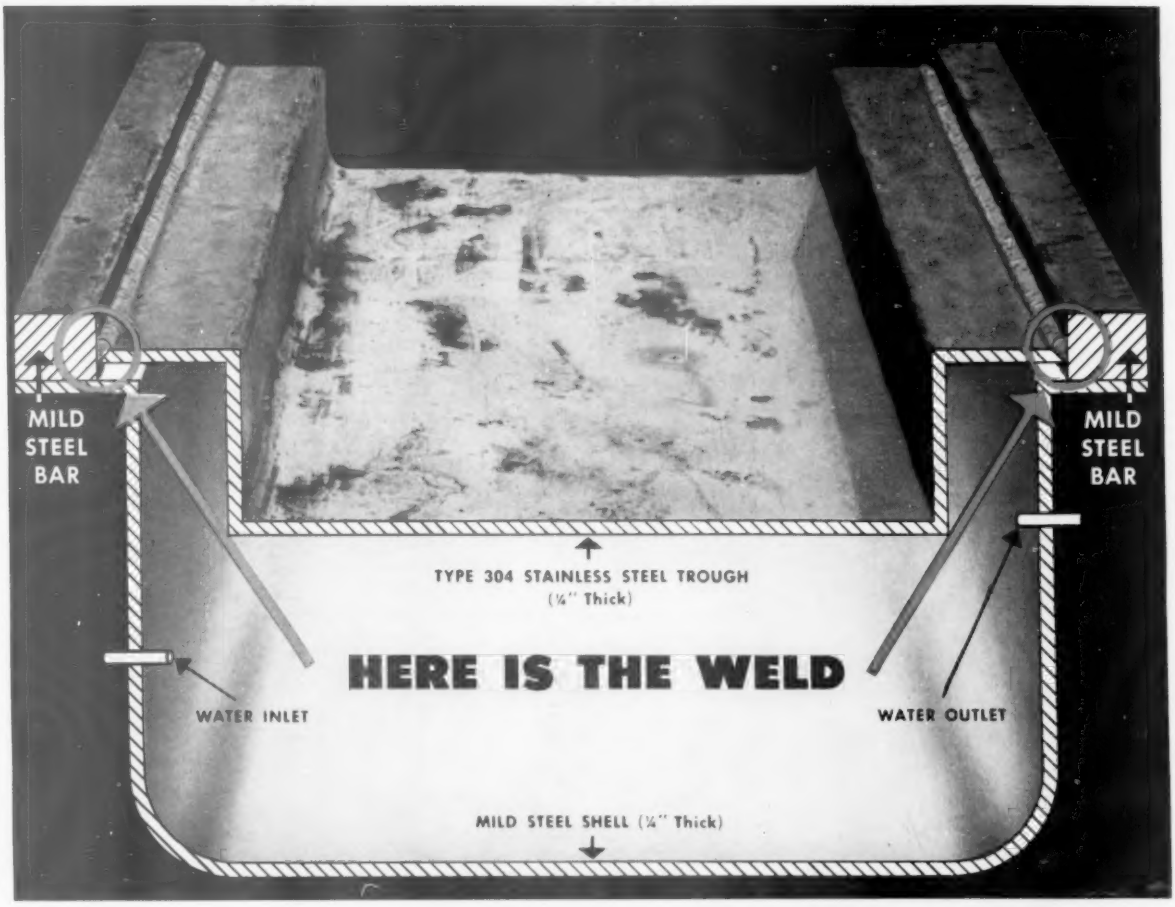

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Inco-Rod "A" joins dissimilar alloys with strong, sound welds

Here's another example of how Inco-Rod "A"* electrode turns difficult dissimilar alloy welds into routine jobs.

A new drag conveyor at International Minerals and Chemical Corporation's Carlsbad plant consists of a 304 stainless steel trough and an outer mild steel shell. Each of its eight 5-foot sections was fabricated by welding trough and shell to mild steel bar. For the critical weld between the stainless and the mild steel, Inco-Rod "A" electrode was used.

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More facts and figures on using Inco-Rod "A" electrode in dissimilar alloy welding are given in Inco's new folder *"Inco-Rod 'A' Electrode."* For your copy, write:

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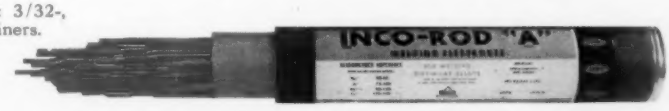
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